EDITORIAL

A Rescue

This will be the third issue of the Dental Journal produced by the editorial staff of the long established West Indian Medical Journal (WIMJ) under the excellent stewardship of Editor-in-Chief, Professor Everard Barton, who initiated the take over of the West Indian Dental Journal from the then co-founding Editors, Dr Anthony Lewis and myself. I must confess the Dental Journal was heading for a premature death prior to this take over by the WIMJ in 2002.

In the last two years, the quality of the Dental Journal has amazed the readership not only for the quality, educative and adequately peer reviewed manuscripts that it continues to present but also for the quality of the printed material which is comparable to that of other international dental Journals.

As one of the two founding Editors of the Dental Journal, one of my dreams has been fulfilled as the Journal now bears the logo of The University of the West Indies, the citadel of academic excellence in the Caribbean today.

The reviewers have an ever-high standard of reviewing and this has manifested itself in the standard of the articles which are not only significant to both the medical and dental fraternities in the Caribbean, but to the world at large. Reviewers deserve special gratitude for despite their busy professional and domestic schedule they have found time to formulate scientifically rigorous opinions of manuscripts. The rejection rate seems to be high but this is what standard and good standing is all about. I have always suspected that Professor Barton also plays the role of technical editor and shoulders the burden of moulding the grammar, spelling and syntax in each manuscript to achieve a copy that alters as little as possible the authors original style bearing in mind that not all authors have English as a first language.

This issue of the Journal is being published as the West Indian Medical Journal (Dental Supplement). The current success of the Journal is resounding because of the quality work of the editorial staff. It will only continue to be as good as those participating in its production, firstly the authors, the reviewers, editors, publishers, readership and again the administrative editorial staff.

Finally, I silently but happily celebrated the 10th year anniversary of a Journal that I founded with my colleague Dr Anthony Lewis in June 1994. Then, we were both afraid that it would die without us. My congratulations to Professor Barton and the editorial staff for a job well done. The Journal is on good grounds.

C Ogunsalu
Assistant Editor

ORIGINAL ARTICLES

An *In Vitro* Comparison of Implant Materials Cell Attachment, Cytokine and Osteocalcin Production

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ABSTRACT

Bone deposition, for any implant system, is the deciding factor for the success. The biochemical signals at the cellular level will help elucidate the direction of host response. In this report, intercellular messenger, cytokines, that are regulatory for osteoblast and osteoclast function, were measured. Production of osteocalcin, a marker for osteoblast maturation was also estimated. Human osteoblast-like cells from osteosarcoma cell line MG 63 were grown in wells in the presence of titanium (Ti), titanium alloy (Ti6A14V) and stainless steel implant materials incubated at 37^{0}C. Interleukin- 1α (IL-1α), IL-6, IL-8, IL-11 and osteocalcin were quantitated using standard enzyme linked immunosorbant assay (ELISA) kits from the growth media extracted at specific intervals over the critical ten day period. In all dishes, cells were seen adhering to the base after 24 hours and to confluence at 96 hours. Both IL-1α and IL-11 were not produced in sufficient quantities to be measured in the assay (< pg/ml). Interleukin-6 production was significantly higher for stainless steel than for titanium and the alloy. There was a progressive rise in osteocalcin production for titanium contrasted to a basal rate for stainless steel and alloy. Interleukin-8 levels for all metals and controls increased markedly after two days implicating inherent cellular characteristics. A relatively high constant range for macrophage colony stimulating factor from the first day was seen for all metals, including the controls. In conclusion, it appears that titanium implants activate osteocalcin production while stainless steel activates IL-6.

INTRODUCTION

The definition of implant success is evolving as more knowledge is gained about their performance and the biological reactions to them (1). The first formal assessments conducted in Sweden were based on what was believed as relevant standards in dentistry. That is, gingival and plaque indices, probing depths and aesthetics (2) were considered. Further definitions of success evolved with more emphasis on the amount of bone loss in relation to the height of the implant (3). The widely cited criteria (4), later modified for specific areas in the dental arches, stated that vertical bone loss should be not more than 0.2mm annually following the implant's first year of service (5). A more specific definition of osseo-integration has been defined as a process whereby clinically asymptomatic rigid fixation of alloplastic materials is achieved and maintained in bone during functional loading (6).

The criteria have thus evolved from a clinical to a histological basis. Implant designs have been correlated with a range of success rates (7) and with treatment modalities for failing units (8). Cancellous bone has a limited capacity for carrying load. Provided that overloading is reduced, it will remodel into a more compact form (9). Surgical sites must be individually assessed and adjunct with bone grafts may be necessary to improve outcome (10-13).

Biocompatibility of an implanted device or biomaterial is determined by the response of the host. This involves acute and chronic inflammation as well as the development of granulation tissue. The monocyte macrophage is derived from blood stem cells and is pivotal in direct and indirect mediated inflammatory reactions. In the elucidation of what makes an implant successful, investigations in terms of the biomolecular signals that are transferred between many cell types and which ultimately direct the development of different cell lines must be defined. Some of these biomolecules have been identified and are referred to as cytokines. The term cytokine is applied to water-soluble glycoproteins, which act as chemical communicators between cells, but not effector molecules themselves. The biosynthesis of cytokines depends ultimately on the structure and expression of the genes that encode them. There is evidence that some are presynthesized and stored either in cytoplasmic granules (14), as membrane proteins (15), complexed with cell surface binding proteins and extracellular matrix (16). These pools of cytokine proteins are available for rapid release in response to stimulation. Most cytokines are not continuously expressed in adult animals but are rapidly produced as needed. The functions of cytokines are diverse. Along with hormones,

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they co-ordinate the activities of different tissues and cell types to maintain homeostasis.

Osteoblasts are derived from a common mesenchymal stem cell that can also differentiate into reticular, fibroblastic, adipocytic and osteogenic cells (17). Cytokines have been found to have effects in all the phases of initiation and differentiation of osteoblast precursors. Specific cytokines found at bone remodelling sites may be used as indicators for bone development. These include IL-6, IL-11, granulocyte-macrophage colony stimulating factor (GM-CSF) and macrophage colony stimulating factor (MCSF) (18). The list of cytokines and colony stimulating factors implicated in the development of osteoclasts include IL-3, IL-6, IL-11, tissue necrosis factor (TNF), GM-CSF, MCSF 18). It may appear confusing that the same cytokine that performs a constructive role also promotes bone resorption. The same cytokine that stimulate bone cell proliferation may have an inhibitory effect on mature osteoblast function. These agents are generally potent stimulators of bone resorption. An explanation for this is that increased levels of certain cytokines lead to the activation of bone resorption. This stops local bone formation to allow unopposed osteoclastic action and osteoblast precursor proliferation for a subsequent phase of bone formation. In this study, cytokines IL-6, IL-8, and MCSF and osteocalcin produced in the presence of commercially pure titanium (cpTi), Ti6Al4V and stainless steel were measured.

METHODS

Osteosarcoma stem cells MG 63 were cultivated under sterile condition in culture flasks containing growth media in a controlled climate. This osteoblast-like cell line has been well characterized and was used as they produce uniform cultures (19). Equal amounts of these cells were then introduced into a template containing separate vials individually containing cpTi, Ti6Al4V, stainless steel and controls. The controls contained only growth media. Small aliquots of the culture media from each vial was removed at two, four, six, eight and ten-day periods and an equal amount of fresh culture media added. The extracted portion was stored at –20^{o}C.

The Preparation of the Growth Media and Implant Materials

The culture media consisted of a mixture of 0.5% fetal calf serum (GIBCO) in Minimum Essential Media (SIGMA) and 0.2% antibiotics. The antibiotics comprised of 100 units/ml penicillin, 100 µg/ml of streptomycin, 0.25 µg/ml of amphotericin B. The implant materials consisted of commercially pure titanium (cpTi), and titanium alloy (Ti6Al4V) discs 3.5 mm in diameter, weight 124.0 mg and stainless steel mesh (3.5 x 3.5 mm) of weight 14.0 mg. All were treated with 1.0% hydro-phosphoric acid, rinsed with distilled water, autoclaved and then dried in an oven.

Preparation of the Culture Cells: Human Osteoblast-like Stem Cells MG 63

Cells were grown in 12-15 ml culture flasks with a potential growth field area of 75 cm^2. They were incubated in a controlled climate at 37^{0}C in humidified atmosphere of 5% CO_2/95% air (LEEC incubator). Cell growth was monitored using a phase contrast microscope and viewed under x10 magnification. When confluent, the culture media was pipetted out and washed with 5 ml Minimum Essential Media, then 5 ml of a 0.25% trypsin in Hanks Balanced Salt Solution (SIGMA) was pipetted into the culture flasks and removed after 20 seconds. This was replaced by 2.5 ml of the same trypsin solution for a further three minutes with slight agitation. This detached the cells effectively from their proteinaceous matrix. Five millilitres of the growth media was pipetted into this suspension and the fetal calf serum in this deactivated any residual trypsin. This suspension was transferred to a centrifuge tube. The cells were centrifuged for 10 minutes at 1300 rpms at room temperature. The media was then aspirated leaving the cells at the bottom.

Cell Count and Plate Set-up

These centrifuged cells were re-suspended in 10 ml of fresh growth media and the cell density determined using a haemocytometer chamber slide stained with 0.4% Trypan Blue Exclusion (Flow Laboratories, IRVINE, Scotland KA12 8NB). Forty microlitres of this suspension containing approximately 40 000 cells were added to each experimental well, in a sterile 24-well experimental plate, containing cpTi, Ti6Al4V and stainless steel. An additional 2 ml of growth media was added to each well. Controls were designed using the identical procedure but leaving out the metals. This experimental template was incubated at 37°C in a humidified atmosphere of 5% CO_2/95% air.

Sample Preparation

Two hundred microlitres were pipetted from each well over a ten-day period every 48 hours and 200 µl of the growth media added at the same time. One control was left untouched throughout the duration of the experiment, after which, samples were taken. The 200 µl aliquot samples were pipetted and frozen at -20°C. In preparation for the quantitation analysis, all 200 µl samples were thawed to room temperature then centrifuged for five minutes at 5000 rpms at room temperature and were divided into four 50 µl portions for analysis by the Enzyme Linked Immuno Assay (ELISA) procedure, (R&D Systems, 4-10 The Quadrant, Barton Lane, Abingdon, OX14 3FA, UK). The results were analyzed by standard ‘t’ test.

Electron Microscope Studies

Scanning electron microscope as well as elemental analysis was undertaken on the implant materials prior to performing the cytokine assay experiments. The elemental analysis of the three metals was carried out under the following

conditions. Scan duration – 100 seconds. Beam acceleration potential – 15 KV, beam current – 500 nanoamps. For the growth pattern studies, the experimental procedures were repeated in an identical manner earlier except that a sterile glass cover slip, 13 mm in diameter was introduced in the wells on top of which the various test metals were then placed. The implant materials with their respective cover slips were removed over the identical ten-day period at the same two, four, six, eight, and ten-day intervals. They were then placed in a sterile 5 ml beaker and fixed with 2.5% gluteraldehyde in 0.5% phosphate buffer solution, pH 7.3 and stored at 4°C in preparation for examination in the electron microscope (Hatachi S 520. Japan). All samples were treated in the following manner: washed in 10% ethanol for 10 minutes, washed in 70% acetone for 20 minutes, washed in 90% acetone for 15 minutes and washed three times in 100% acetone for 15 minutes. The samples were then dried to critical point (Critical point dryer CD 750 ENSCOPE, England) at 900lbs/in^2 for 1.5 hours. Increased pressure to 1200 lbs/in^2 then slowly reduced pressure to normal atmospheric. Gold coated with a sputter coater (Sputter coater SC %) ENDSCOPE, England).

At the end of the experiments, all cells and disposable equipment were soaked in 15% clorax solution. Pipettes, reagent bottles and other plastic containers were placed in a toxic disposal bag for appropriate treatment.

RESULTS

Quantitative analysis of IL-6, IL-8, MCSF and osteocalcin are shown in the Table. Interleukin-1α and IL-11 were not found in any samples within the sensitivity range (pg/ml) of the ELISA kits. IL-6 was produced mainly by titanium and stainless steel. For titanium, IL-6 values ranged from 131.7 to 217.8 pg/ml and for stainless steel from 125.0 to 452.2 pg/ml. Thus, a much higher production of IL-6 was found for stainless steel. The alloy Ti6Al4V produced 112.9 pg/ml on the eighth day (Fig. 1). Interleukin-8 production rose significantly for all samples including the controls after two days. After two days IL-8 peaked to 5671.8 pg/ml and maintained a constant high for titanium (5671.8-5567.0 pg/ml). Smaller values were found for the stainless steel (4563.0-3789.0 pg/ml) and the alloy (3456.7-2167.0 pg/ml). The controls also produced IL-8 but profiles showed the smallest quantities (1980.0-2145.0 pg/ml) (Fig. 2). All wells produced high levels of MCSF from the first day, titanium (6782.0-7823.0 pg/ml) stainless steel (6912-7342.0 pg/ml) alloy (6945.0-7891.0 pg/ml) and controls (6914.0-7312.0 pg/ml) (Fig. 3). Osteocalcin was not found in any of the controls. There was a progressive production of this glycoprotein from 4.2 ng/ml to 24.6 ng/ml in wells containing titanium. A basal rate of osteocalcin production was seen for stainless steel (3.2-3.7 ng/ml) over the ten-day period and even less, 1.4 ng/ml and 2.9 ng/ml on the second and eighth days respectfully for the alloy (Fig. 4). Elemental

Table: Quantitative analysis

Cytokine

Interleukin-6 (pg/ml)

	Titanium	STDEV(+/-)	Stainless Steel	STDEV(+/-)	Alloy	STDEV(+/-)	Control	STDEV(+/-)
2 days	131.7	17.4	125.7	16.2		0		0
4 days	156.7	23.4	143.6	21.7		0		0
6 days	146.8	21.6	452.2	27.8		0		0
8 days	217.8	19.8	356.7	34.6		112.9	32.9	0
10 days	143.6	12.8	289.4	19.8		0		0

Interleukin-8 (pg/ml)

	Titanium	STDEV(+/-)	Stainless Steel	STDEV(+/-)	Alloy	STDEV(+/-)	Control	STDEV(+/-)
2 days	256.8	45.1	234.9	98.1	121.9	55.9	290.1	58.9
4 days	5671.8	234.8	4563	198.1	3456.7	234.1	1980	312.1
6 days	5123	215.9	4106	209.7	3178	176.8	2145	165.8
8 days	5423	256.9	3137	242.8	2167	199.3	1784	167.8
10 days	5567	267	3789	195.9	3126	215.9	2081	189.2

Macrophage Colony – Stimulating Factor (pg/ml)

	Titanium	STDEV(+/-)	Stainless Steel	STDEV(+/-)	Alloy	STDEV(+/-)	Control	STDEV(+/-)
2 days	7049	123.8	6998	128	7431	178	6914	218
4 days	7823	109.8	7189	151.8	7534	128.9	7312	170
6 days	6782	112.8	6912	98.7	6945	143.7	7431	191
8 days	7213	132.1	7342	80.3	7110	153.5	7191	182
10 days	7321	142.3	7103	121.8	7891	187.5	7214	197

Osteocalcin (ng/ml)

	Titanium	STDEV(+/-)	Stainless Steel	STDEV(+/-)	Alloy	STDEV(+/-)	Control	STDEV(+/-)
2 days	4.2	1.1	3.7	1.1		2.9	1.7	0
4 days	7.8	2.8	3.4	1.9		0		0
6 days	12.8	4.2	3.2	2.1		0		0
8 days	18.8	5.3	3.5	2.4		1.4	0.9	0
10 days	24.6	3.7	3.7	1.7		0		0

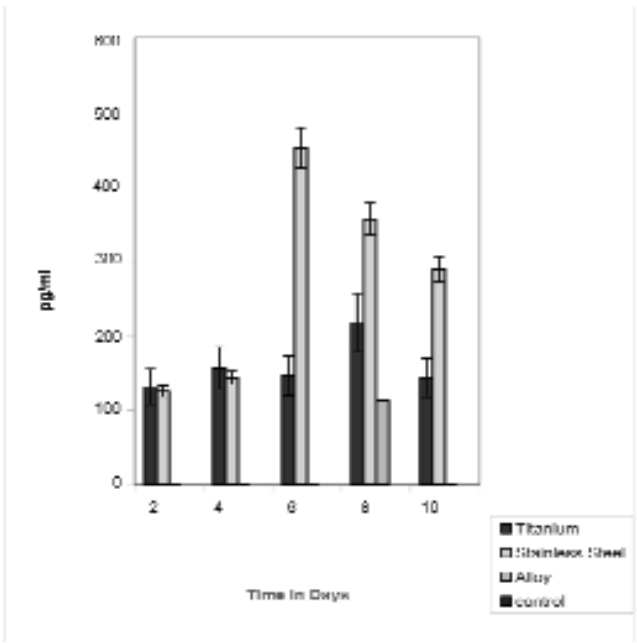

Fig. 1: The production of interleukin–6 from MG 63 cells

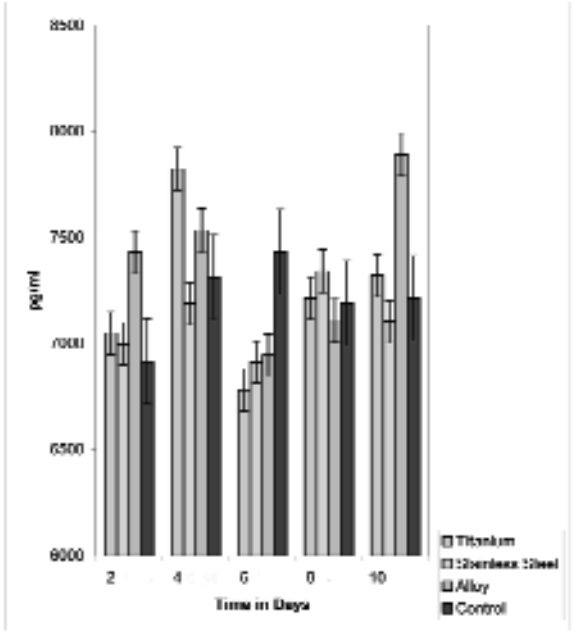

Fig. 3: Production of macrophage colony-stimulating factor

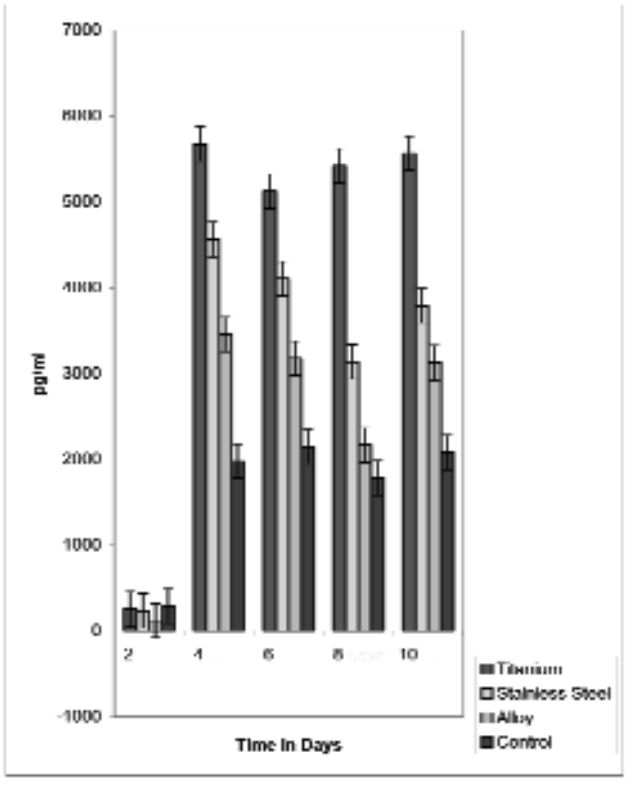

Fig. 2: Production of Interleukin-8

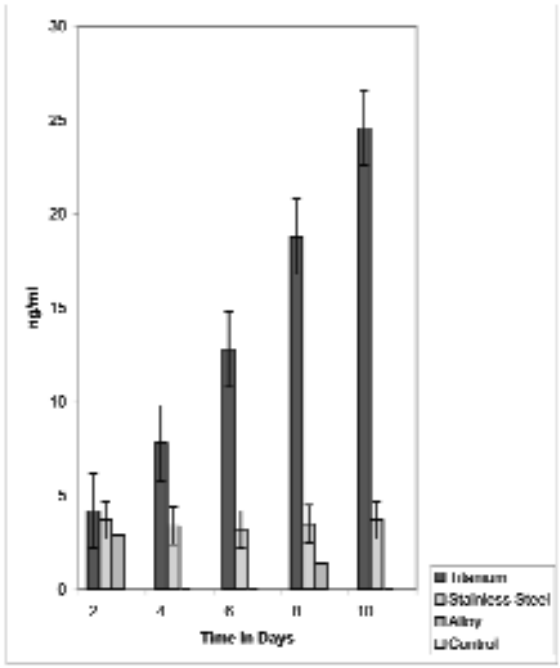

Fig. 4: Production of osteocalcin

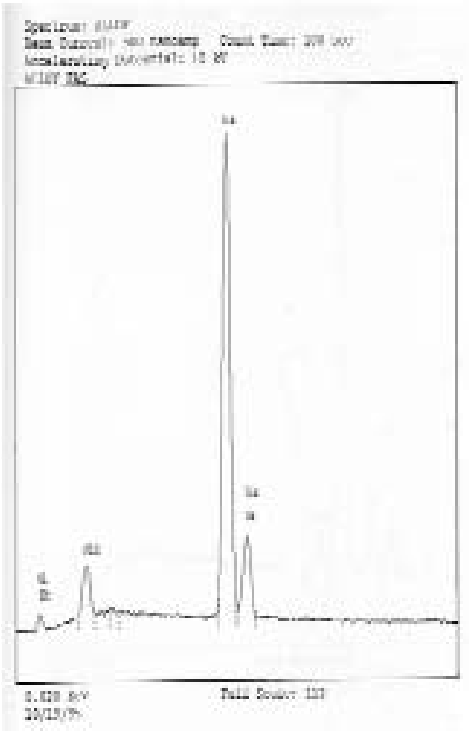

Fig. 5: Spectral analysis of titanium alloy

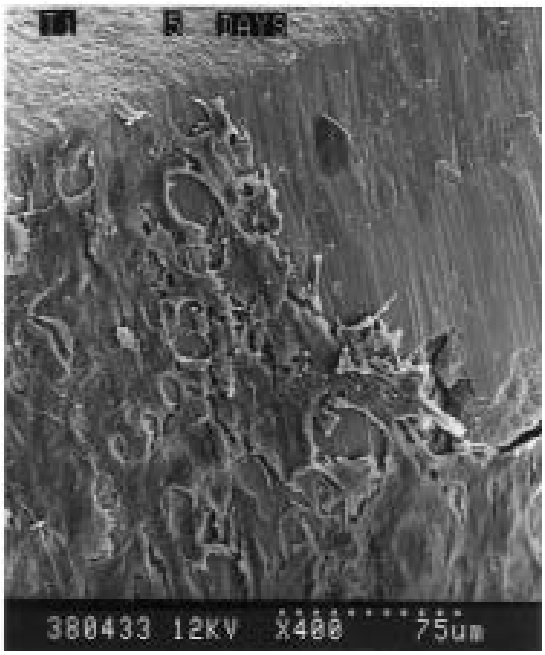

Fig. 6: Cell MG 63 Osteoblast cell line showing growth pattern

analyses for the three metals show six peaks for stainless steel. These correspond to the presence of chromium, iron, and nickel. There were two peaks for titanium and four peaks for the alloy (Fig. 5). Different surface topography was seen between the metals. The least irregular surface was seen for the stainless steel mesh at a magnification of x350 when compared to the other metals at the same magnification. Titanium surface at x350 magnification revealed debris that was removed after cleaning. At x350 magnification, the alloy appeared similar to titanium except that striation can be seen on the alloy. This may be due to the machine preparation of the disc. Cells were seen adherent on all metals within five days. At ten days, an increase in cell growth was seen for all metals (Fig. 6).

DISCUSSION

The use of primary bone cells has been hampered by the consistency of the cell population. Current *in vitro* model systems include transformed cell lines. These exhibit osteoblast behaviour at a specific stage of maturity (17). Transformed human osteosarcoma cell lines, in this case, MG63 may contribute to the understanding of osteoblast function because they represent initial clonal population derived from a specific osteoblast lineage (19). It has been argued that *in vitro* systems cannot replicate the intact mediator or intracellular coregulatory mechanisms that can be found *in vivo* (20). Widespread use of all these culture systems has resulted frequently in divergent responses to the same osteotropic agents being observed. It is not always possible to extrapolate effects of osteosarcoma cell culture with those of bone cell cultures because osteosarcoma cells possess abnormal growth characteristics. Primary bone cell cultures contain heterogeneous cell populations comprised of cells at a different stage of maturation.

Interleukin-1α levels were not detected and if present, were below the sensitivity range. It is synthesized primarily by the monocyte macrophage lineage including osteoclast. In degenerative conditions, it is produced primarily by activated macrophages. Its production by osteoblast thereby occurs in less significant quantities. Studies conducted on quantitative IL-1α secreting assay around bone implants have shown that it is a reflection of the number of macrophages around the failing implants (21). Interleukin-1 (IL-1α and IL-1β) is centrally involved in the effector phase of inflammatory response. It may be found in fluids around failing implants in patients who exhibit T-lymphocyte mediated hypersensitivity to metal prostheses (21). It has been commonly mentioned as a marker for bone resorption and periodontal disease (22). In a review of the cause of implant failures (22), an increased response from T-lymphocytes implies that failure may not be due to simple mechanical failure or giant cell reaction to wear debris. The presence of T-lymphocytes and the absence of accompanying B-lymphocytes or plasma cells suggest immunological reactions in the tissues adjacent to the prosthesis. Such a response indicates type IV sensitivity. Implant failure can thus occur after primary osseo-integration. Elemental analysis of metals adjacent to failing implants revealed the complete absence of aluminium and vanadium. Animal studies show that vanadium is very soluble and is cleared from the circulation quickly through the kidneys while titanium is insoluble and remains in the

adjacent tissues (21). It is interesting to note that patients who had negative patch test to titanium salt solution reacted positively to metitanium ointment (23). These results are of course contradictory. There is no standardized procedure for testing titanium sensitivity and no data on the incidence of sensitivity in the general population. Several reports call into question the suitability of titanium alloy as a material for prosthetic implants (21). It is susceptible to fretting corrosion and its metal debris can cause cellular reaction and osteolysis (24-26).

Interluekin-11 was not found in any of the samples including controls in this study whereas MCSF was found in all wells. MCSF is important for the survival, proliferation and differentiation of mononuclear phagocytes, including osteoclast. It is an important mediator of the inflammatory response and can regulate the release of other proinflammatory modulators from macrophages. The high and relatively constant value for the MCSF is notable. However, no factor can be correlated with the inhibition or stimulation of this cytokine.

From the experimental results, it can be seen that under the conditions specified, both titanium and stainless steel stimulate IL-6 production. A relatively constant lower rate for titanium and a three-fold increase for stainless steel by day six was observed. An increase in osteoclast activity may also infer a coupling mechanism thereby releasing growth factors for osteoblast precursors. Interleukin-6 is a multifunctional cytokine. Osteoblastic cells in bone have been reported to produce IL-6 (27). This activity is also stimulated by factors that enhance bone resorption (27). Elevated levels of IL-6 are involved in bone destruction and induce hypercalcaemia (27). In some instances, IL-6 failed to demonstrate bone resorbing activity and low levels may act as a local inhibitor of bone resorption (27).

Significant production of IL-8 was found in all wells by day four. While the levels decreased for stainless steel, alloy and the controls, titanium maintained a fairly constant high range from day four to termination of the experiment. The various activities of IL-8 implicate this cytokine as having a major role in mediating inflammatory responses. A correlation exists between the expression of IL-8 and altered cell shape (28, 29). Early studies indicate that cell attachment is better on a roughened surface (30), although the surface morphology does not appear to affect cell spreading (31). Titanium may be considered, in light of the kenetropic effects of IL-8 on cells, to enhance initial cell spreading over the implant surface.

In this study, osteocalcin remained at a steady low for stainless steel. There was a progressive increase for titanium. This may suggest titanium as a factor for faster bone mineralization around titanium implants. A low basal rate with stainless steel may possibly cause a slower response. The deficiency of osteocalcin production seen for the titanium alloy is difficult to interpret since comparable osseointegrative properties of titanium and its alloy have been reported (17). The role of osteocalcin as a marker for late maturation and mineralization of bone reveals favourable support for titanium implants. It has been used as an indicator for osteoblast activity in several studies (32). A low basal rate for stainless steel may indicate a slower response for osteoblast maturation. The relative steady state production of osteocalcin by MG 63 cells exposed to stainless steel in these experiments correlates with earlier reports with human differentiated osteoblast cells (33). One of the main limitations of stainless steel for clinical use is the tendency to corrode when implanted. The release of metallic ions of iron, chromium and nickel into human tissue and fluids must be regarded as a likely source of long-term problems owing to their known toxicity. Chromium has been reported to concentrate in the nucleus and mitochondria, interact with DNA and RNA, inhibit oxidative metabolism and induce neoplastic cell formation (34). Nickel has been proven to induce significant inhibition of mitosis (35). Measurements of osteocalcin directly reflect the metabolic activity of osteoblastic bone cells.

The usefulness of cytokine measurements solely to monitor disease activity is controversial. Assays of bioactivity, notorious for their lack of specificity, have long given way to sensitive immunochemical assays with improved specificity. The ELISA kits, as well as other immunological assay systems, have been facilitated by the rapid development of recombinant cytokine technology. These, however, have been plagued with problems; for example, the lack of cytokine inhibitors, soluble receptors, autoantibodies and complement components (36). Different assay systems may therefore account for some of the discrepancies in the literature regarding the presence or absence of certain cytokines. It remains to be determined how these autoantibodies alter the measurement of serum cytokine by ELISA kits.

Controlled experiments performed *in vitro* undoubtedly provide valuable information of primary functioning systems. *In vivo* testing may find more factors directly and indirectly involved with bone metabolism and possible reveal new variables. In the asymptomatic patient, it is not always clear if the clinical or radiographic findings represent active disease or evidence of past disease. Analyses, which may be more sensitive and highly specific, must be developed to eliminate the false positive results that occur with various proteins that react with assay reagents.

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Spectrum of Oral and Maxillofacial Surgical Procedures in Kano, Nigeria

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ABSTRACT

The goal of the maxillofacial surgeon is to correct facial deformity while eradicating surgical diseases, prevent recurrence or complication and restore function. The aim of this paper is to review the surgical procedures carried out in a new tertiary teaching hospital. A retrospective study of patients with maxillofacial surgical diseases seen at the Department of Dental and Maxillofacial Surgery, Aminu Kano Teaching Hospital, Kano, Nigeria, between 2001 and 2003, was conducted. A total of 87 patients had various (primary and secondary) surgical procedures during the period under review. There were 51 males and 36 females, a male to female ratio of 1:0.61 with an age range of 3 days to 90 years and a mean age of 34.5 years. The majority of the patients were in the lower socio-economic group. Reduction and immobilization of the jaw fractures (n = 21, 23.3%) was the most common, followed by transosseous wiring (n = 12, 13.3%). The most common complications were malocclusion (n = 14, 29.8%) and facial defects (n = 12, 25.5%). Reduction and immobilization, and tumour surgery of the jaws seem to be the most common surgical procedures while osteotomy was the least. Reduction and immobilization with simple arch bars appeared to be very effective, more so when the patients could not afford more modern methods of treatment. Reconstructive surgeries of ablated jaws are advocated in view of the devastating aesthetic and psychosocial effects that these have on the patients.

INTRODUCTION

The aim of maxillofacial surgeries is to eradicate active diseases and to prevent recurrence and complications. Maxillofacial trauma (1-3) and tumours (4,5) with their attendant morbidity constitute some of the major problems with which the maxillofacial surgeon in this environment is confronted. Therefore facial disfigurement (6,7) is one of the main reasons for presentation at the maxillofacial clinics.

Successful accomplishment of restoration of function and aesthetics usually depends on the experience and dexterity of the surgeon and the facilities available. The purpose of this paper is to review the scope of maxillofacial surgical procedures and complications of such procedures during a two-year period (2001-2003) of practice by the authors at the Dental and Maxillofacial Surgery Department, Amino Kano Teaching Hospital, Kano, Nigeria. The centre serves four of eight states in Nigeria's northwest geopolitical region.

MATERIALS AND METHODS

This is a retrospective study conducted at the Department of Dental and Maxillofacial Surgery, Amino Kano Teaching Hospital, Kano, Nigeria, over a two-year period between May 2001 and April 2003. All patients who had maxillofacial surgical procedures were identified from the record file of the unit and their case notes were retrieved and reviewed.

A total of eighty-seven patients had various surgical procedures during the period under review. All cases were managed by the authors. Apart from the trauma and congenital cases, all other patients with swellings, cysts and tumours were histopathologically diagnosed. The demographic data, surgical procedures and complications were then analyzed using Microsoft Excel.

RESULTS

Eighty-seven patients representing 77.7% of total patients presenting with maxillofacial surgical diseases during the period under review had 98 (90 primary and 8 secondary) surgical procedures. There were 56 males and 31 females, a male- female ratio of 1.9:1. The age range was from three days to 90 years (mean = 34.5 years) (Table 1) and the majority (n = 30, 34.5%) were in the third decade of life.

The socio-demographic characteristics are shown in Table 1. Based on the type of anaesthesia employed, 77 (88.5%) were classified as major while the remaining 10 (11.5%) were classified as minor procedures. Socio-economic stratification of the patients was carried out using occupation according to the assessment of Oyedeji (8) with a modification. Class I were senior public servants, professionals, managers, contractors, businessmen, large scale traders and farmers; class II - intermediate grade public servants and senior school teachers; class III - junior grade public servants, artisans, drivers and small scale businessmen; class IV - labourers, messengers, petty traders and similar grades; class V - students, unemployed, full time

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Table 1: Personal characteristics of the patients

Characteristics	Number	%
Gender distribution		
Male	56	64.4
Female	31	35.6
Mode of anaesthesia		
Major/general anaesthesia	77	88.5
Minor/local anaesthesia	10	11.5
Occupation		
Professionals (lawyers, doctors, engineers etc)	4	4.6
Artisans (barbers, tailors, mechanics, hairdressers etc)	5	5.7
Small scale business	7	8.0
Trading	18	20.7
Farming	11	12.6
Teaching	3	3.4
Civil servants	10	11.5
Students	13	14.9
Labourers/messengers/cooks	2	2.3
Drivers	6	6.9
Unemployed/housewife	8	9.2
Age:		
Range	3 days to 90 years	
Mean	34.5 years	

housewife, subsistence farmers. Thirty-two (36.8%) were in social class V while 4 (4.6%) were in social class I.

Table 2 shows the diagnosis/indications for surgery with mandibular fracture (n = 24, 27.6%) being the commonest. The surgical procedures included reduction and immobilization (n = 21, 23.3%), trans-osseous wiring (n = 12, 13.33%), resection (n = 7, 6.73%) and others (Table 3). Less common procedures were C–shaped ostectomy, inverted L-osteotomy, bicoronal flap, grafts and correction of ectropion. The most common complication was malocclusion (n = 14, 29.8%), followed by facial defects (n = 12, 25.5%) and others (Table 4). Seven (58.3%) of the 12 facial defects were observed following resection with disarticulation. Secondary surgical procedures (n = 8) were carried out to correct some of these complications.

DISCUSSION

This study showed a wide variation in the scope of maxillofacial surgical procedures encountered during the period under review in a new tertiary hospital. In this study, among the cysts, tumours and tumour-like lesions of the jaws, the odontogenic tumours, led by ameloblastoma, remain the commonest. This trend is in line with global reports (5, 9). Regarding the non-tumour lesions, trauma (n = 46, 55.2) was the commonest with mandibular fracture being the leading indication in that group. Facial trauma in Nigerian Africans are common (1,2,10,11). The age range in this study is in conformity with publications on maxillofacial surgical diseases (1,3,9). There were two very young patients with congenital cleft lip and palate. The various surgical procedures in this study were in line with prescribed procedures employed for maxillofacial surgical diseases.

Table 2: Diagnosis/indications for surgery

Diagnosis/indications		Number	%
Odontogenic tumours			
	Ameloblastoma	4	4.6
	Ameloblastic fibroma	1	1.2
Cysts	Odontogenic keratocyst	1	1.2
	Dentigerous cyst	1	1.2
	Dermoid cysts	2	2.3
	Frontal sinus cyst	1	1.2
Fibro - osseous			
	Ossifying fibroma	2	2.3
	Fibrous dysplasia	1	1.2
	Cementifying fibroma	1	1.2
Salivary gland tumours			
	Pleomorphic adenoma (parotid)	5	5.7
	Spindle cell cancer (submandibular gland)	1	1.2
	Ectopic salivary gland	1	1.2
Non – odontogenic tumours			
	Osteosarcoma	1	1.2
	Giant cell granuloma	1	1.2
Congenital			
	Cleft lip and palate	8	9.2
	Ankyloglossia	2	2.3
Trauma			
	Middle 1/3 # (maxilla)	7	8.0
	Mandibular #	24	27.6
	Zygomatic complex #	5	5.7
	Nasal complex #	1	1.2
	tissue injury/avulsion/laceration	9	10.3
	Ectropion upper eyelid	1	1.2
	Contracture (nasolabial region)	1	1.2
Others			
	osteomyelitis	2	2.3
	Bilateral TMJ dislocation	1	1.2
	Ankylosis	1	1.2
	Collapsed anterior frontal sinus	1	1.2
	Foreign body in cheek	1	1.2
Total		**87**	**100%**

The commonest post-operative morbidity were facial defects, malocclusion and drooling of saliva. These occurred following surgical ablation of the mandible with resultant loss of sulcus depth. This is similar to the report of Adekeye and Apapa (12). Reconstruction of the lost segments usually alleviates these (13 -15). Unfortunately, because of the low economic empowerment of most of the patients (Table 1), only two of them had reconstruction of mandibular defects, one with autogenous iliac crest bone graft and the other insertion of Steinmann's pin (Table 5).

Table 3: Primary surgical procedures

Surgical procedures	No	%
Enucleation	2	2.2
Resection with disarticulation	7	7.7
Repair	8	8.8
Excision	6	6.6
Surgical shaving	1	1.1
Release of contracture	1	1.1
Reduction and immobilization	21	23.3
Suturing	7	7.7
Débridement	3	3.3
Parotidectomy	5	5.5
Trans-osseous wiring	12	13.3
Percutaneous approach	2	2.2
Sequestrectomy	2	2.2
Release of ectropion and skin grafting	4	4.4
Coronoidectomy	1	1.1
Acrylic cap splint	2	2.2
Release of ankyloglosia	1	1.1
Onlay graft (alloplastic)	1	1.1
Removal of foreign body	1	1.1
C-shaped ostectomy	1	1.1
Inverted L-shaped osteotomy	1	1.1
Bicoronal flap	1	1.1
Total	**90**	**100%**

Table 4: Post - Operative complication

Complications	No	%
Facial nerve weakness/paralysis	3	6.4
Parotid fistula	2	4.3
Oro-nasal fistula	1	2.1
Wound breakdown	2	4.3
Malunion	1	2.1
Post-traumatic headache	2	4.3
Trauma (burns) to lip from surgical drill	1	2.1
Drooling of saliva	4	8.5
Speech difficulty	3	6.4
Immobility of tongue	2	4.3
Facial defects	12	25.5
Malocclusion	14	29.8
Total	**47**	**100%**

Table 5: Secondary surgical procedures

Indications	Secondary surgical procedures	No	%
Loss of mandibular segments	autogenous iliac bone crest graft	1	12.5
Loss of mandibular segments	insertion of Steinmann's pin	1	12.5
Wound breakdown	secondary suturing	1	12.5
Wound breakdown	skin grafting	1	12.5
Malunion with aperthognathia	refracture with trans-osseous wiring	1	12.5
Oronasal fistula	repair	1	12.5
Parotid fistula	cannulation of the duct	2	25.0
Total		**8**	**100%**

Most Nigerian patients attending tertiary institutions are usually in the lower and intermediate socio-economic group (16-19). Ameloblastoma is notorious for its high recurrence rate (20-22).

In this study, recurrence was post-surgical shaving of a fibrous dysplasia.

Our experience has shown that fibro-osseous lesions in indigenous Africans are unrelentless in their growth, hence excision of lesion is recommended. Two years is a short period to comment on recurrence of odontogenic tumours as some are reported to have recurred 30 years post operatively (22). Facial nerve weakness post-parotidectomy recovered about six weeks post-operatively following physiotherapy and neurobion/Vit. B complex therapy in two cases except where it was sacrificed during radical parotidectomy. Post-traumatic headache is usually one of the components of post-concussional syndrome (22) which usually resolves with time.

CONCLUSION

This study has highlighted the various surgical procedures carried out at the Department of Dental and Maxillofacial Surgery, Aminu Kano Teaching Hospital, Kano, Nigeria. Reduction and immobilization and tumour surgery of the jaws seem to be the most common surgical procedures while osteotomy was the least. Reduction and immobilization with simple arch bars appeared to be very effective, more so when the patients could not afford more modern methods of treatment which are relatively expensive. Reconstructive surgeries of ablated jaws are advocated in view of the devastating aesthetic and psychosocial effects that these have on the patients.

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Blood Pressure, Heart Rate and Temperature Variability during Periodontal Surgery

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ABSTRACT

The aim of the present study is to investigate changes in blood pressure, pulse rate and temperature before and after periodontal surgery. The study included 127 normal healthy patients (43 males, 84 females) with age range 9 to 65 years (mean age: 26 ± 12 years) who underwent periodontal surgery. After administration of a local anaesthetic agent (Ultracain DS®) containing 0.06 mg adrenaline, the blood pressure, pulse rate, and temperature were measured. Based on the type of operation, the patients were divided into four groups. Statistically significant changes (as decreasing) in all parameters were observed (blood pressure : systolic 111.3 ± 20.1, diastolic 67.7 ± 13.1, pulse rate: 87.8 ± 14.9, temperature: 36.3 ± 0.3) but these changes were significantly decreased after operations (blood pressure: systolic 105.9 ± 19.7, diastolic 62.6 ± 11.3, pulse rate: 84.01 ± 13.1, temperature: 36.2 ± 0.3). And without age group differentiation in all parameters, statistically significant decreases were found among females ($p \leq 0.05$).

INTRODUCTION

Most dental treatments are conducted under local anaesthesia and it is well known that dental surgery causes increase in blood pressure, even in normotensive patients (1). The factors influencing this increase are not yet fully understood. It is important to determine factors causing the blood pressure response during dental surgery because fatal subarachnoid haemorrhage and massive bleeding related to dental surgery and high blood pressure have been reported (1). Previous studies have demonstrated that increases in blood pressure during tooth extraction are related to difficulties in tooth extraction and the volume of local anaesthetic used (1-5). The role of the autonomic nervous system in the blood pressure response induced by dental surgery has not yet been resolved. Studies have shown that an increase in blood pressure during dental surgery seems to be mediated primarily by an activation of the sympathetic nervous system (6-11).

METHODS

The study included 127 patients (43 males, 84 females), 9 to 65 years of age (mean age 26 ± 12) who underwent periodontal surgery at the Faculty of Dentistry, Cumhuriyet University, Turkey. The details of the procedure and clinical trials were explained to all patients and written informed consent was obtained from each. All patients were asked to complete a questionnaire on medical history and current medical therapy. According to the type of operation, the patients were divided into four groups (gingivectomy, periodontal flap, surgery, frenectomy and curettage). After administration of local anaesthetic (Ultracain DS®) containing 0.06 mg of adrenaline, baseline blood pressure, pulse rate and temperature were measured and recorded before and after periodontal operation. Also, the patients were divided into subgroups according to their education, age and gender. Statistical analysis (impaired t-test) was applied.

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RESULTS

The changes in blood pressure, pulse rate and temperature during periodontal surgery under local anaesthesia were analyzed. The blood pressure (systolic and diastolic), pulse rate and temperature of the first group were decreased after operation ($p \leq 0.05$). The blood pressure (systolic and diastolic), pulse rate of the second group were decreased ($p > 0.05$) but the temperature did not change ($p > 0.05$) (Table 1). In the third and fourth groups, the blood pressure and pulse rate did not change ($p > 0.05$), but the temperature was significantly decreased ($p \leq 0.05$) after operation (Table 1).

According to the level of education, the patients were studied in four categories (Ignorant = 0, Basic education = 1, High school = 2, University = 3). Statistically all parameters were found to have significantly decreased among the patients who had basic and high school education after operation. There was no significant change observed in temperature ($p > 0.05$) among the patients who had university degrees; other parameters were significantly decreased ($p \leq 0.05$) (Table 2).

Regardless of age group differentiation, there was statistically significant decrease in all parameters among females ($p \leq 0.05$). Excluding systolic blood pressure, the other parameters were decreased in males ($p \leq 0.05$) (Table 3).

According to gender and age, the patients were subdivided into four groups (1 = 9-19, 2 = 20-29, 3 = 30-39, 4 = 40-60). In the first age group, statistically significant changes in pulse rate and temperature were observed ($p \leq 0.05$) but no such significant change in blood pressure (systolic and diastolic) was observed among females. In all parameters, no significant changes were observed among

Tables 1 & 2

Tables 3 & 4

males ($p > 0.05$). In the second age-group, excluding temperature, the other parameters were significantly decreased among females. Excluding temperature and pulse rate, the other parameters were decreased ($p \leq 0.05$) among males. In the third group, the only significant decrease was observed in pulse rate among females but no significant decreases were observed among males in all parameters. In the fourth group, statistical changes were observed among females in systolic blood pressure. No statistically significant changes were observed among males in all parameters (Table 4).

DISCUSSION

It is well known that blood pressure and pulse rate increase during tooth extraction. The contribution of the sympathetic nervous system in this increase is not well understood (2-5). Because the administration of local anaesthetics without dental treatment fails to increase plasma noradrenaline concentrations, the blood pressure response seem to be dependent on the dental treatment itself (2). Recent study observed that peak plasma adrenaline concentrations are reached just after the administration of local anaesthetics with adrenaline, while the peak plasma noradrenaline concentrations are obtained during tooth extraction. This difference in time-course of plasma catecholamines suggests that the adrenaline present in the local anaesthetic leaks into the systemic circulation instead of an activation of the sympathetic nervous system being the primary factor affecting the increase in blood pressure during tooth extraction (2-6).

In this study, the blood pressure, pulse rate and temperature were significantly decreased after gingivectomy operation ($p \leq 0.05$). The blood pressure and pulse rate were significantly decreased ($p \leq 0.05$) but the temperature did not change after flap operation ($p > 0.05$) The blood pressure and pulse rate did not change ($p > 0.05$), but the temperature was significantly increased ($p > 0.05$) after frenectomy and curettage operation.

Some studies revealed that the systolic blood pressure significantly increased above the preoperative control, throughout surgery, but diastolic pressure did not change significantly throughout surgery when compared with the preoperative control. The pulse rate increased just after the local anaesthesia and lowered afterward (2, 12). Increases in systolic blood pressure induced by tooth extraction correlated significantly with the age of the patient.

In this study, according to the level of education, the systolic blood pressure did not show any statistically significant changes ($p > 0.05$) but in the other parameters changes were found to be statistically significant in the patients who had basic education. Statistically important changes were found in all parameters among the patients who had high school education and significant changes were found only in temperature among the patients who had a university degree.

Many studies, in different age groups, showed that middle-aged and older patients have greater increases in blood pressure during dental surgery than younger patients (4). Another study suggests that the maximum blood pressure changes were more intense during surgery in boys than in girls (6).

In this study, important changes in pulse rate and temperature were observed between 9 and 19 years of age in female patients but these changes were not observed among males. In another group (aged 4 – 40 years) the only important change was observed in temperature. A change in systolic blood pressure was observed among females but no such change was observed among males of this group.

CONCLUSION

Many factors such as patient age, gender, education, the volume of local anaesthetic, the length of the treatment and the difficulty of the procedure may be strong determinants of the extent of the increase in blood pressure. All the parameters that showed statistically significant changes may only increase more in medically compromised patients and such patients may warrant more precaution and routine monitoring during periodontal and implant surgery.

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The Comparative Effectiveness of Two Digit-Sucking Deterrent Methods

CO Bourne

ABSTRACT

A study was conducted to compare the effectiveness of the crib and positive reinforcement in eliminating anterior open bites and increased overjets caused by digit-sucking. The overjet and overbite were measured using an overjet ruler at the start and end of the seventeen-week observation period. Forty patients consented to participate but measurements were only obtained for 11 subjects. The trend in this study is that the crib is more effective than positive reinforcement in preventing digit-sucking.

INTRODUCTION

Digit-sucking (*ie* thumb or other finger) and its sequelae are a highly common cause of concern of parents of patients who visit dentists. As many as 90% of children develop a digit-sucking habit (1). Although malocclusions are seen in the primary dentition due to persistence of digit-sucking (Fig. 1), many children give up the habit before the permanent teeth erupt (2) and the presence of features of malocclusion in the primary dentition stage caused by digit-sucking does not indicate the likelihood of developing the same features of malocclusion in the permanent dentition. About half of those who start a digit-sucking habit still do so at seven years of age (3). Persistence of the habit during the mixed dentition stage results in the deflection of the permanent incisors from their path of eruption. The resultant increase in overjet (OJ) (Fig. 2) can predispose the digit-sucking patient to traumatic injury to the incisors– fracture and avulsion are most common.

Cessation of the habit in most children is associated with social influence - peer pressure in playgroups or at school. Children who have crossed this hurdle for more than a year without breaking the habit on their own need some form of interceptive therapy. Although an increased overjet and reduced overbite can spontaneously improve if the patient can be persuaded to discontinue the habit early in the mixed dentition, it rarely results in a complete resolution of the problem (4). Interceptive therapy can only be 100% successful for these patients when the problem is not severe and treatment is timed correctly.

Fig. 1: Digit (thumb) sucking

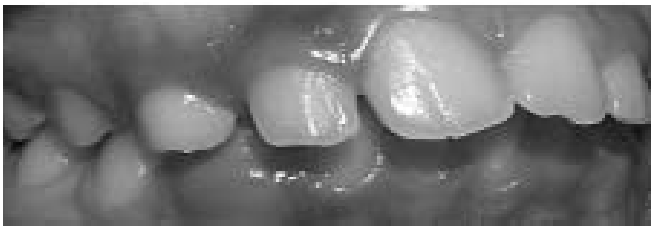

Fig. 2: Increased overjet

For these reasons, the first line of therapy is positive reinforcement: the child is rewarded for making the effort to discontinue the habit. This line of therapy was found to be just as effective as negative reinforcement and treatment with appliances in a study reported by Larsson (5). His study placed 76 children (nine years of age) in four treatment groups (19 in each) and found no statistically significant differences between the active treatment groups; the small sample size in each group may have resulted in the results being skewed.

Negative reinforcement is often tried first by parents. This ranges from application of bitter flavouring agents to the digit to many forms of punishment of the child for continuing the habit. Other simple mechanical deterrent approaches described in the orthodontic literature include: alteration of the child's pyjamas so that the hand cannot be moved to the mouth and sucking is rendered impossible; tubes attached around the elbows or gloves around the wrist (6). Less dramatic procedures are currently recommended to avoid the risk of psychological trauma.

A gentle deterrent orthodontic appliance forms the second line of therapy. The pre-requisites for this are:

- The child should have demonstrated an understanding of the purpose of treatment and be motivated;
- Upper first permanent molars should be fully erupted or, less preferably, the upper second deciduous molars should not be mobile (to allow retention of the orthodontic appliance).

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The level at which the clinician has been trained determines whether a removable appliance or a fixed appliance is provided. A removable appliance can be issued by a dentist with minimal orthodontic training and can be more easily altered in design to be retentive at an early stage of the mixed dentition. A crib in the form of an upper removable appliance is shown in Figures 3 and 4. Unfortunately, the fact that the patient can remove the appliance makes it fail to be effective in many cases; many children subconsciously remove them while sleeping. Fixed appliances are thus preferable when the clinician has the skills to use them (Fig. 5).

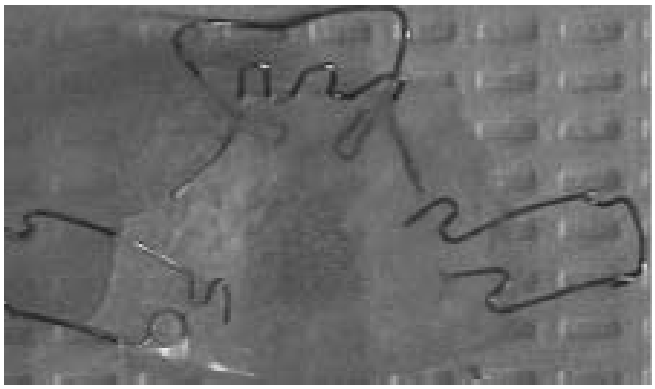

Fig. 3: Crib/upper removable appliance

Fig. 4: Upper removable appliance on the study model used for fabrication

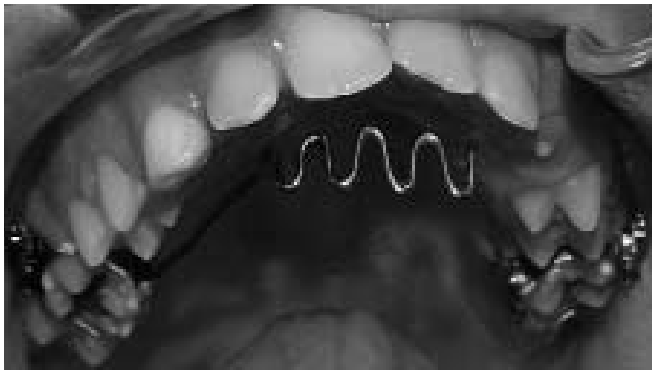

Fig. 5: Transpalatal archcrib

The fixed appliance used as a deterrent is most commonly a variation of a Transpalatal Arch (TPA) that impedes placing the digit in the mouth. It can be constructed with spurs or other auxilliaries to discourage the child from sucking the digit (due to discomfort) but this style is no longer popular. The deterrent appliance is referred to as a crib due to the simple design of the metal framework protectively enclosing the front area of the mouth.

The effectiveness of the crib needs to be compared to that of positive reinforcement using an adequate sample size. No publication of a well conducted scientific study on the effectiveness of the crib is available. Thus, the study presented here was conducted to compare the effectiveness of the crib and positive reinforcement in treating anterior open bites and increased OJ due to digit-sucking (Fig. 6).

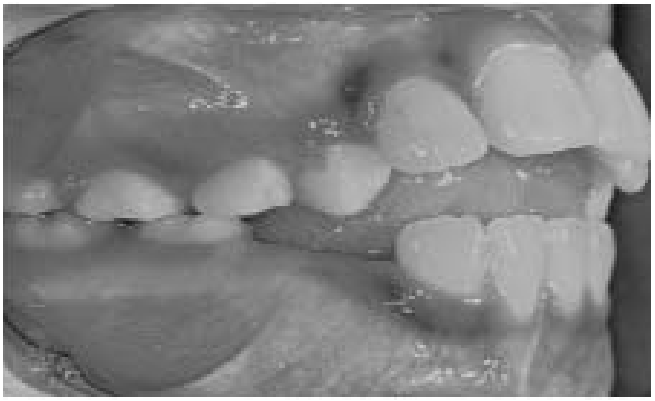

Fig. 6: Anterior open bite

SUBJECTS AND METHOD

Forty digit-sucking patients of the Child Dental Health Clinic in the School of Dentistry of The University of the West Indies, St Augustine, Trinidad and Tobago, consented to participate in this study. Subjects invited to participate had to satisfy the following inclusion criteria:

(i) Age seven or eight years.

(ii) The child must be developmentally capable of the following skills:
- Understanding of cause and effect relationships
- Ability to grasp another person's point of view (peer/parent/professional)
- Comprehension of the concepts of time in terms of past, present and future
- An appreciation of intrinsic values (*eg* aesthetics)
- Ability to discriminate between right and wrong
- The capacity to practice some degree of self-control and self-denial.

(iii) A current habit of sucking a digit while awake and asleep.

(iv) An increased OJ of at least 6 mm and/or the presence of an anterior open bite.

(v) The potential for the permanent central incisors to fully erupt as indicated by no more than 75% root formation.

(vi) No craniofacial anomalies *eg* cleft lip and palate.

(vii) No learning disabilities.

Subjects were then randomly allocated to three groups: one group treated with positive reinforcement; another group treated with a crib; and a third (control) group that received no treatment for a similar period of time.

Procedure

Treatment with positive reinforcement involved three review visits around two, eight and sixteen weeks respectively after the initial visit. During the first visit for treatment, progress charts were provided for the parent/guardian to record the number of hours per day that digit-sucking is seen and/or reported to occur. A reward system was agreed on with the child and parent on this day as well. The OJ and overbite (OB) were measured at the start of the initial observation period and at the eight- and sixteen- week visits.

The OJ and anterior open bite or OB of patients treated with a crib were recorded using an overjet ruler at the start and end of the observation period (of 16 to 17 weeks). The observation period began after the TPA/crib was cemented in the mouth. To ensure that instructions were followed, a review visit two weeks after provision of the TPA/crib was arranged.

The sample studied reduced to eleven subjects treated with either a crib or positive reinforcement alone and three control subjects. After testing the results (*ie* reductions in OJ and increase in OB) for normality, two-sample *t*-tests were done using the statistical analysis software package, SPSS for Windows.

RESULTS

The initial OJ and OB mean and range for subjects treated with a crib or positive reinforcement are shown in Tables 1 and 2 respectively. Subjects in the control group experienced no change in OJ or OB. Statistical comparison of the results is shown in Tables 3 and 4.

DISCUSSION

Treatment with a crib or positive reinforcement improves

Table 1: Results for subjects treated with a crib

Subjects	OJ (mm)	OB (mm)	Reduction in OJ (mm)	Increase in OB (mm)
1	10.0	-3.0	2.5	2.5
2	6.0	-4.5	1.0	3.0
3	5.5	-4.0	3.0	3.5
4	6.5	-3.0	-0.5 (↑)	3.5
5	2.0	-4.5	0.0	2.0
6	5.0	3.0	4.0	1.0
μ	5.83	-2.6	1.67	2.58
Range	**2 - 10**	**-4.5 – 3**	**-0.5**	**1-3.5**

Table 2: Results for subjects treated with positive reinforcement

Subjects	OJ (mm)	OB (mm)	Reduction in OJ	Increase in OB
7	5.0	-1.0	1.0	3.5
8	8.0	-1.5	0.0	-0.5 (↑)
9	2.0	-4.5	0.0	2.0
10	8.5	1.0	1.0	2.5
11	6.0	1.5	-0.5 (↑)	-0.5 (↑)
μ	5.9	-0.9	0.3	1.4
Range	**2 – 8.5**	**-4.5 – 1.5**	**-0.5-1**	**-0.5-3.5**

Table 3: Analysis of OJ reduction results using t-test

Treatment	n	Mean (mm)	Standard deviation (mm)	Standard error of the mean	*p value* (equal variances assumed)	95% Confidence interval (lower limit)	95% Confidence interval (upper limit)
Crib	6	1.67	1.78	0.726	0.141	-0.201	3.534
PR	5	0.30	0.67	0.300	–	-0.533	1.133

Table 4: Analysis of OB increase results using *t*-test

Treatment	n	Mean	Standard deviation (mm)	Standard error of the mean (mm)	*p value* (equal variances assumed)	95% Confidence (lower limit)	95% Confidence Interval (upper limit)
Crib	6	2.583	.970	.396	.185	1.565	3.602
PR	5	1.40	1.817	0.812	-	-0.856	3.656

the OJ and OB as seen by the results displayed in Table 2. Comparison of the means clearly indicates that the crib is more effective than positive reinforcement for reduction of an increased OJ and increase of a reduced OB. However, the difference in the mean and the standard error of the mean (SEM) reduction in OJ for subjects treated with a crib (n = 6; 1.833 ± 0.641) and subjects treated with positive reinforcement (n = 5; 0.500 ± 0.224) does not appear to be statistically significant due to the 95% confidence interval of the difference containing zero. Similarly, the difference in the mean (and the SEM) results for OB increase for subjects treated with a crib (n = 6; 2.583 ± 0.396) and subjects treated with positive reinforcement (n = 5; 1.600 ± 0.714) does not appear to be statistically significant.

Larsson's study (5) is not appropriate for comparison as the appliances used in his study were probably designed for active movement of teeth with wire components unlike the cribs used in this study. However, as Larsson's conclusion (that the effect on the OJ and OB is likely to be the same regardless of the treatment modality that is used) agrees with the statistical analytical conclusion of this study, two important weaknesses of Larsson's study that unfavourably influenced the inference must be considered here. A sample size of 19 in each subgroup is too small to be representative of an entire population. Also, the age of the patients in his study indicates that the incisors were likely to have developed fully and consequently, the incisors could not erupt further to affect the OJ and OB significantly.

The results of the study presented here are also useful despite the limitation of the sample which needs to be increased. Attrition of the sample occurred mainly due to one of the following reasons. One was the fact that a large number of patients failed to return for follow-up appointments after the digit-sucking habit was broken – the treatment was effective in eliminating the cause but we do not know how great an effect it had on the symptoms. Another reason was the failure of a few patients and/or their parents to use the positive reinforcement system to get any success (*ie* the child continued to suck a digit whether a reward was given or not). A third major factor was the limitation of members of the research team involved in data collection. Several academic staff members of the Child Dental Health Unit of the School of Dentistry examined patients at their initial visit but were unable to do follow-up examinations due to: being part-time; other commitments being overwhelming; an unexpected resignation and inability to notice the need for reminder calls due to the preceding reasons.

Methodology implemented in this study will be improved on when the study is continued. A much greater effort will be made to ensure that follow-up appointments are attended. This will involve more emphasis, to the parents, of the importance of the follow-up visits and the members of the research team involved in data collection. The latter will only participate if their involvement in the Child Dental Health Clinic (where subjects are recruited) includes at least two whole days of teaching and a half-day of administration per week. Manpower problems for the study will be largely irrelevant after manpower problems for the Child Dental Health Unit of the School of Dentistry are reduced. Although some attrition of the sample will be expected, less attrition should occur as continuation /repetition of the data collection stage will only be possible with the addition of at least two more academic staff members.

CONCLUSIONS

The trend in this study is that the crib has an advantage over positive reinforcement alone but this was not supported by statistical analysis. This study needs to be continued to increase the sample size and consequently increase the power of the study.

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CASE REPORTS

A New Surgical Management for Oro-antral Communication

The Resorbable Guided Tissue Regeneration Membrane – Bone Substitute Sandwich Technique

C Ogunsalu

ABSTRACT

This paper describes a new technique for the closure of oro-antral fistula/communication, in which both hard tissue (bone) and soft tissue closure is achieved. The sandwich technique utilizes a suitable bone grafting material sandwiched between two sheaths of Biogide® (a resorbable membrane) for the hard tissue closure of oro-antral communication post traumatic exodontia. The bone grafting material utilized for this case was Bio-oss. The result obtained was excellent with regeneration of sufficient bony tissue to allow placement of an endosseous implant. This sandwich technique is a simple and excellent technique for the closure of oro-antral communication, especially when subsequent placement of endosseous implant is considered without the need of donor site surgery for bone grafting. The otorhinolaryngologists and oral and maxillofacial surgeons should find this technique very useful in the closure of oro-antral fistulae.

INTRODUCTION

One of the clinical complications encountered by oral surgeons is oro-antral communication (OAC) with progressive formation of oro-antral fistula (OAF). The incidence of this complication may vary from 0.31% to 3.8% after simple extraction of maxillary teeth (1, 2). Buccal sliding flap, palatal flap, soft palate flap and related modifications are the various modalities available for the management of OAC or OAF (3-10). These techniques have the following shortfalls:

- Buccal sliding flap reduces the depth of the vestibular sulcus, hence need for a vestibuloplasty
- Only soft tissue closure is achieved, hence the need of complex hard tissue (bone) grafting when endosseous implant is considered
- Severe pain and scarring in palatal flaps; the palatal denuded area takes too long to heal.

Recently, Yoshimasa *et al* (11) reported the use of 3rd molar transplantation as a technique in which closure of OAC is achieved without the need for further prosthodontic treatment of the single tooth missing in the region**.** This proposed modality of treatment by Yoshimasa *et al* is promising and unique but has the following pitfalls:

- Extraction of the 3rd molar, which is to be transplanted, may lead to any of the known complications of 3rd molar extraction.
- OAF cannot be closed in this manner.
- Root canal treatment of the transplanted tooth is indicated, and this should be continuously monitored for failure.

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Our technique using the Bio-oss-Bio-Gide Sandwich technique is particularly unique because it excludes all the above shortfalls and further has the advantage of concurrent bone tissue regeneration in the OAC/OAF site, which will enable the placement of an endosseous implant in future without the need for complex maxillary sinus lift procedure. This is the first reported case of the sandwich technique utilized for the closure of oro-antral communication (OAC) in the English Language literature.

Bio-Gide® (Fig.1) is a pure collagen membrane obtained by standardized controlled manufacturing processes. The collagen is extracted from veterinary certified pigs and carefully purified to avoid antigenic reactions. It is sterilized in double blisters by gamma irradiation, it is as such a bilayer structure. The porous surface facing the bone will allow the in-growth of bone-forming cells. The dense surface facing the soft tissue will prevent the in-growth of fibrous tissue into the bony defects. The membrane is made of type I and type III collagen without further cross-linking or chemical treatment. When used as a barrier membrane in bone cavities, it will resorb within 24 weeks. Adverse reaction to Bio-Gide has not been observed.

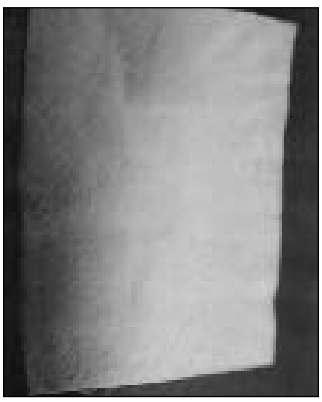

Fig. 1: Picture showing Bio-Gide

Bio-Oss® is a safe and effective bone graft material. Under the election microscope, Bio-Oss looks very similar to human bone. Because of this similarity to human bone, Bio-Oss is highly successful in helping new bone to form. It is prepared from specially processed bovine sources. Since it is highly purified bone, no allergic reaction or infection has been observed following its use.

Case Report

A 40-year-old Jamaican male was referred to the Cornwall Dental Centre by his Dentist, with a history of recently created OAC, following the extraction of the right maxillary second molar. Clinical examination and panoramic tomogram confirmed the presence of the oro-antral communication (Fig. 2).

Based on the author's previous use of Biogran-Bio-Gide Sandwich technique for the reconstruction of the maxillary sinus floor following tumour surgery (12, 13), and the excellent outcome in terms of the quality and quantity of bone regenerated (13), the sandwich technique for bone regeneration was used for the first-time in the closure of this OAC. This procedure was done on the same day of presentation and the immediate post-operative radiograph revealed adequate bone height and stabilization of the bone in the subantral region in the location of the OAC (Fig. 3).

Technique

Some cancellous granules of Bio-Oss® were sandwiched between sheaths of appropriately trimmed Bio-Gide® which were previously sutured together in three sides using 3/0 vicrly (resorbable) suture. The fourth side was then adequately closed using the same suture after the Bio-oss® had been inserted, thus creating a closed sandwich. The sandwich is prepared in such a way that it has a smooth side which is marked with "up" and a rough side (Fig. 4). A full thickness mucoperiosteal flap was raised in relation to the buccal aspect of the edentulous area of #17 extending from #16 to the mid-point of tooth #18.

The prepared sandwich was tucked into the OAC in such a way that it formed a convexity towards the sinus and a concavity towards the alveolar bone. The rough surface of the sandwich is faced to the alveolar bone and additional bio-oss is filled into this concavity. Marginal alveolectomy is performed and flaps repositioned and sutured in place whilst achieving primary closure. The suturing was made water-tight. Postoperative orthopanthomogram was taken (Fig. 3) to radiologically quantify the amount of bone grafting/augmentation and closure of oro-antral fistula.

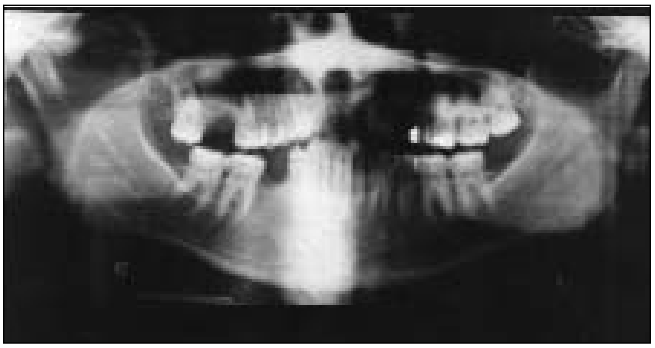

Fig. 3: DPT immediately post repair of oro-antral communication with the sandwich technique – note good quality and quantity of repair

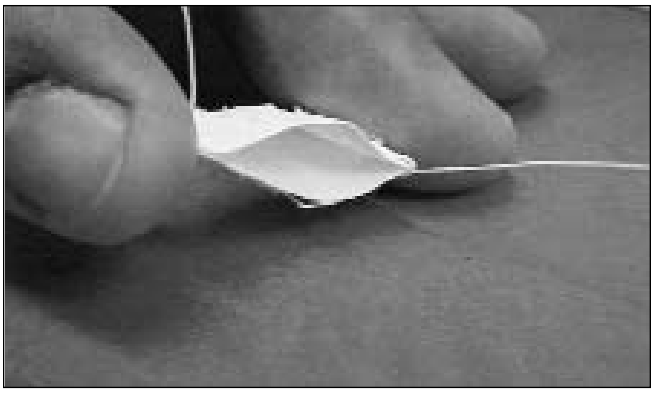

Fig. 4: Picture showing the Bio-Oss-Bio-Gide open sandwich

Outcome

A follow-up radiograph at eight months showed the creation of a new maxillary sinus at the bony floor and subantral bone of good quality and height that can permit the placement of an endosseous implant (Fig. 5).

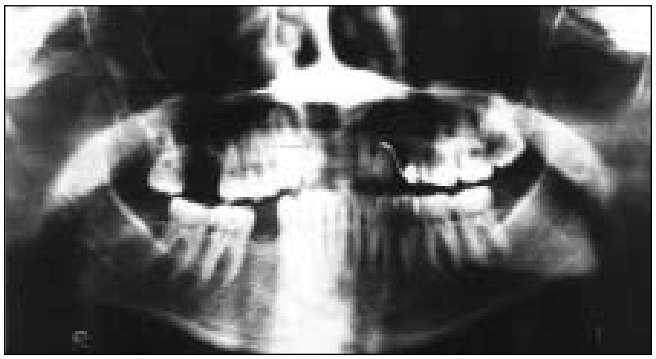

Fig. 2: DPT showing an oro-antral communication in the right maxilla

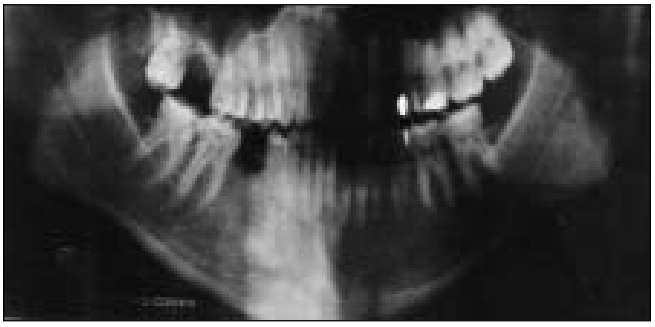

Fig. 5: DPT showing the repaired area eight months post surgery – note the maintained good quality and quantity of bone

DISCUSSION

The sandwich technique in the closure of oro-antral communication/fistula is new and promising. Ogunsalu *et al* first used this technique in 2000 in the reconstruction of the maxillary sinus floor and alveolus post excision of a bone destroying lesion without the need of bone graft donor site. In their classic papers (12, 13), the authors suggested other possible application of this technique to include reconstruction of orbital floor, closure of oro-antral fistula, frontal sinus ablation and reconstruction of table, reconstruction of bony cleft defects and mastoid ablation.

As no donor site surgery is necessary, this is an advantageous technique in terms of time saving, cost and, more importantly, less discomfort to the patient during and after surgery. Furthermore, both bony (hard tissue) and soft tissue closure is achieved for oro-antral communication in contrast to only soft tissue closure obtained by buccally sliding flap and palatal flaps. The reconstructed bony tissue regenerated from this technique will also be able to receive an endosseous implant.

In their recent publication, Khan *et al* (14) concluded that SPECT offers a simple, reproducible, objective and physiologic approach to studying the osseointegration process that occurs after placement of endosseous implant. This method can also be utilized for the measurement of osteoblastic activity index following the sandwich technique. This will enable us to predict/determine how soon endosseous implants can be placed after such technique has been utilized in regenerating bone.

The main objectives of the current clinical approaches to tissue replacement and reconstruction are to alleviate discomfort and to restore mechanical stability and function. The current modalities for treating lost tissues include the utilization of autogenous grafts, allografts, synthetic materials and xynografts. Although all these modalities of treatment have been successful, each of them has its own limitation or shortfall. One of the main problems with autogeneous graft is the fact that humans do not have a significant store of excess tissue for transplantation. Also, relating to replacement of lost bone, donor site morbidity, anatomic and structural problems and increased level of bone resorption during healing are among the problems with autogeneous bone grafting.

The sandwich technique thus offers a promising approach to replacement of lost bone without the above mentioned limitations. This technique can also be used successfully in the closure of typical post extraction oro-antral fistula as long as the ingrowing oral tissue into the fistula is removed appropriately.

CONCLUSION

The sandwich technique in the management of oro-antral communication or fistula, in this single case, has yielded excellent results in terms of hard tissue and soft tissue closure. Furthermore, it has regenerated more than enough bone to enable placement of an endosseous implant in position #17.

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Non-Syndromal Multiple Buried Supernumerary Teeth

Report of Two Cases from the English-speaking Caribbean and a Review of the Literature

AS Ramsaran, S Barclay, E Scipio, C Ogunsalu

ABSTRACT

Multiple supernumerary teeth affecting all four quadrants of the jaw are a rare dental anomaly which has become a chance finding on routine dental panoramic tomography (DPT). In this paper, two cases from the English-speaking Caribbean are reported. The role of radiography in the diagnosis and management of this rare developmental dental anomaly is emphasized. The paper stresses the importance of ruling out associated syndromes such as Gardner's Syndrome, cleidocranial dysostosis and cleft lip and palates, as multiple supernumerary teeth are usually related to such conditions. There is a review of the literature as it relates to supernumerary teeth.

INTRODUCTION

Teeth or tooth substance in excess of the usual configuration of 20 deciduous and 32 permanent teeth would be designated supernumerary teeth. Supernumerary teeth may occur singly, multiply, unilaterally or bilaterally and in one or both jaws. Rarely it can occur in all the four quadrants of the jawbone as in the index cases. The classification of supernumerary teeth is shown in Table 1.

Table 1: Classification of supernumerary

Classification based on form	Classification based on position
Conical supernumerary	Mesiodens
Tuberculate type	Paramolar
Supplemental type	Distomolar
Odontome	Parapremolar

Cases involving one or two supernumerary teeth most commonly involve the anterior maxilla followed by the mandibular premolar region (1, 2). The most commonly affected site of multiple supernumeraries (> 5) is the mandibular premolar region (3). Various studies have been conducted regarding the prevalence and significance of supernumerary teeth. However, most studies and publications are deficient in that they lack definite management of multiple (buried) supernumerary teeth when such are not related to a syndrome or symptom.

It is the intention of this paper to stress the importance of non-treatment and appropriate radiological follow-up for asymptomatic, non-syndromic multiple buried supernumerary teeth and to review the literature on this topic.

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Case Report 1 - Jamaica

A 13-year-old Jamaican female of African descent presented to the Cornwall Dental Centre in Jamaica with a complaint from the mother of over-retained deciduous teeth and a palatally erupted upper left premolar tooth. The clinical examination confirmed such complaints. The dental panoramic tomogram (DPT) which was required as a compulsory investigation prior to treatment and advice revealed supernumeraries in the location designated in Figure 1.

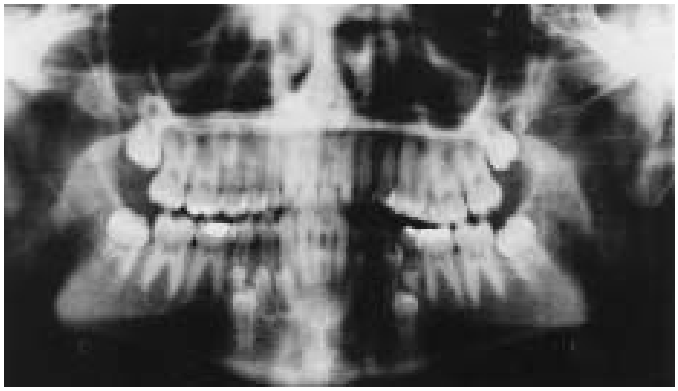

Fig. 1: Dental panoramic tomogram of case 1 showing multiple buried supernumeraries (all four quadrants are involved)

A total of ten supernumerary teeth were seen, nine of which were unerupted supernumeraries (S^{UE}). The DPT (Fig. 2) showed no other abnormality or evidence of cystic degeneration around any of the unerupted supernumeraries.

The palatally erupted parapremolar of the left maxilla was surgically extracted revealing two roots (Fig. 3). The mother was reassured that the unerupted asymptomatic supernumeraries were best left alone as attempts at surgical removal might result in damage to vital anatomical structures such as inferior dental nerve or mental nerve. It was suggested that a follow-up DPT be taken every three

Table 2: Chart showing location of unerupted supernumeraries S^{UE} in case 1

S^{UE} S^{UE}																S^{UE}	S^{UE}
48	47	46	S^{UE}	45	S^{UE}	S^{UE}	44	S^{UE}	43	42	41	31	32	33	S^{UE}	34	35	S^{UE}	S^{UE}	36	37	38

Fig. 2: Shows the extracted palataly erupted parapremolar in case1 with 2 roots.

Fig. 3: DPT of case 2 shows 11 asymptomatic supernumeraries.

Table 3: Chart showing the location of erupted and unerupted supernumeraries.

																						28
48	47	46	S^{E}	45	44	S^{E}	43	42	41	S^{UE}	31	32	33	S^{UE}	34	35	S^{UE}	S^{UE}	36	37	38	

years to enable early detection of any cystic degeneration associated with the unerupted teeth. The patient was further clinically examined and assessed to rule out syndromes such as basal cell nevus syndrome and cleidocranial dysostosis. Gardner's Syndrome was also ruled out.

Case Report 2 - Trinidad

A 32-year-old Trinidadian male of East Indian descent presented to the Dental Polyclinic at the School of Dentistry, The University of the West Indies, St Augustine, Trinidad and Tobago, with pain in the left mandibular region due to a grossly carious tooth #37. There was nothing of significance in his medical history. However, the clinical examination revealed left submandibular lymphadenopathy extra- and intra-orally.

The patient showed poor oral hygiene, multiple carious lesions, multiple supplemental/supernumeraries in the upper left and lower right premolar regions (3 on the upper left and 2 on the lower right), distal rotation of 11, and mesiodens in the upper anterior region with absence of tooth #21 clinically. Radiographically the DPT (Fig. 4) revealed 11 asymptomatic supernumeraries: 6 erupted (S^{E}) and 5 unerupted (S^{UE}) (Fig. 5).

DISCUSSION

Prior to the discussion on the management of multiple unerupted supernumerary teeth, it is important to mention the effect of supernumerary teeth on the developing dentition. These effects are as follows: no effect, crowding, failure of eruption of adjacent permanent teeth, displacement and ectopic eruption, formation of diastema, root resorption of adjacent dentition, dilaceration of adjacent dentition and loss of vitality.

In a recent study in Jamaica of 478 dental panoramic tomograms, Hayes (4) reported an incidence of 3.14% for supernumerary teeth occurrence with no statistically significant difference between the males and females (4). Of these, 53.33% were distomolars (4^{th} molar). Two cases, both males, involved the presence of distomolars in all the four quadrants of the jaw. Equal numbers of first and second premolars were found as well as two lower incisors. However, only two mesiodens were found and involved a female and a male patient. Additionally, a male patient with distomolar (4^{th} molar) in each quadrant also exhibited evidence of a 5^{th} molar or tubercle in the upper left tuberosity region.

The classification of supernumerary teeth is seen in Table 1. They vary from a simple odontome through a conical type to a supplemental type. The incidence of supernumerary teeth varies according to published studies. They are less common in the deciduous dentition with a reported incidence of 0.3% to 1.7% of the population (5). The overall prevalence of supernumerary teeth however varies between 0.1 and 3.6 per cent of the population (3). Fuss and Sampson (2) reported an incidence of 2.3% in Australia (2). Luten (6) reported an incidence of 2% (however this would be more as his radiographic method included the use of the bitewing and periapical radiographs, without the use of DPT, hence the exclusion of deeply buried supernumerary teeth and distomolars). The relative frequency of different supernumerary teeth as reported in the literature seems to differ. Luten's study (6) suggested a

decreasing order of frequency of 50% for upper lateral incisors, 36% for mesiodens, 11% for upper central incisors and 3% for the bicuspids. Shapira and Kuftinec (7) reported an order of decreasing frequency as being upper central incisors, molars (especially upper molars) premolars followed by lateral incisors and canines. The incidence of multiple supernumeraries is lower than that of single and double supernumeraries. In their study, Fuss and Sampson reported 68.6% for single supernumeraries, 20.3% for double and 11.1 % for multiple supernumeraries.

Most authors have reported a male: female ratio of 2:1 (2, 8). A much higher male : female ratio has been reported for Japanese children (5.5:1) and children from Hong Kong (6.5:1) in a study of supernumerary teeth in Asian school children.

Definitive diagnosis and elucidation of a treatment plan can only be formulated after appropriate clinical and radiological assessment. The assessment should also be capable of including or excluding a syndrome in association with the multiple unerupted supernumeraries. Observation and follow-up radiographs may be the only treatment necessary if buried teeth are asymptomatic and show no evidence of cyst formation. Radiological assessment should be periodical.

Symptomatic multiple buried supernumerary (MBS) may have to be surgically removed after appropriate education of the patient and parent about the risk of damage to adjacent teeth and vital anatomical structures. On the other hand, surgical removal of some MBS may be indicated for orthodontic reasons. Distraction osteogenesis with or without orthodontic treatment may also play a role in the definitive treatment of MBS.

The two cases in this report did not require any definitive treatment other than the extraction of the parapremolar in Case 1. Long-term radiological follow-up is suggested for early detection of cystic degeneration of the buried teeth. This is best carried out by periodic dental panoramic tomogram.

CONCLUSION

Multiple buried supernumerary teeth are rare dental developmental anomalies, usually a chance finding on radiographs. Controversy continues with regards to optimal treatment. Because of the increasing use of DPT in the Caribbean, it is important for the general dental practitioner to appreciate the radiological presentation of MBS teeth and also the need for no treatment in most cases except the long-term clinical or radiological follow-up of the affected patient.

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Cemento-osseous Dysplasia in Jamaica

Review of Six Cases

C Ogunsalu, D Miles

ABSTRACT

Six cases of cemento-osseous dysplasia (COD) of the jaw bone in Jamaicans are reviewed. Five were documented over a 15-year period (1980 - 1995). These include a case of florid cemento-osseous dysplasia (previously called gigantiform cementoma). Three of the initial cases were histologically diagnosed as gigantiform cementoma. There was no indication in the patient's case file whether these were familial or non-familial. The other two cases were diagnosed histologically as periapical cemento-osseous dysplasia and cementoblastoma respectively. Based on the current understanding of the nature of florid-cemento-osseous dysplasia (FLCOD), a new case was diagnosed as such solely on radiological findings. This single case of FLCOD is reported and discussed against the background of other cemento-osseous lesions. Special emphasis is placed on the radiology of COD in this paper. The confirmative role of radiology without the need for histophathology and treatment for asymptomatic FLCOD is emphasized.

INTRODUCTION

The gigantiform cementoma (GC) is a very rare condition which is classified by the World Health Organization as a distinct histopathological entity. According to Agazzi and Belloni (1), the lesions have their onset at a young age, develop slowly and usually involve all four quadrants of the jaws. The lesion occurs in families and appears to be inherited as an autosomal dominant characteristic, although other reported cases are non-familial and do not support this claim. The benign cementoblastoma is a common lesion (2-6). Langdon (7) pointed out the exceptionally rapid growth and aggressive behaviour of cementoblastoma.

The periapical cemental dysplasia is classically described as a lesion of rather common occurrences; its nature is not fully understood (8). Some authors adhere strongly to a theory of it originating from odontogenic tissue (cementum) while others believe that it represents only an unusual reaction of the periapical bone. It is not considered a neoplasm (8). Florid cemento-osseous dysplasia (FLCOD) was initially reported as florid osseous dysplasia by Melrose *et al* (9) who described a condition that has come to be accepted as the most clinically extensive form of cemento-osseous dysplasia (COD), thus the use of the term florid. The diagnosis of FLCOD is a clinical and radiographic one, and biopsy is not necessary. A patient must manifest the typical changes in at least two quadrants for a clinical and radiologic diagnosis of FLCOD to be made. A four quadrant disease may be suggestive of a familial nature.

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PATIENTS AND METHODS

All cases histologically diagnosed as COD in Jamaica over a 15-year period (1980 – 1995) were reviewed in terms of clinical and radiographic findings. An additional new case of FLCOD diagnosed in 2002 is also documented in this paper in the form of a case report.

RESULTS

A total of six cases are documented in this study from Jamaica. Five cases of COD were seen over a 15-year period (1980 – 1995); three cases of gigantiform cementoma (total of five lesions) and one case each of cementoblastoma and periapical cemental dysplasia. These cases are summarized in the Table together with a new case of FLCOD seen in 2002.

All were females with an age range of 23 – 70 years and an average age of 52.2 years. All cases were symptomatic prior to discovery, the first five cases presenting as jaw swelling and the sixth presented as persistent pain from the right mandible without any obvious dental cause.

Case Report

A 23-year-old Jamaican female of African descent presented to the Cornwall Dental Centre Montego Bay, Jamaica, with severe pain of the right mandible in the molar region. Localization of the pain to one of the molars was not possible. Clinical and initial radiographic examination with a periapical radiograph did not show any dental cause for the pain.

Dental Radiologic Findings

A dental panoramic view revealed radiopaque and radiolucent lesions of the mandible bilaterally with radiographic evidence of root resorption of teeth # 37 and #

Table: Summary of cases of cemento-osseous dysplasia in Jamaica

Cases	Gender	Age (years)	Site	Radiographic findings	Histological findings
1	F	56	Posterior mandible	Large area of radiopacity with surrounding radiolucency	Gigantiform cemento
2	F	49	Bilateral mandible in 876|678 region	Bilateral multiple radiopaque masses with surrounding zone of radiolucency 876|678 region.	Gigantiform cemento
3	F	47	Bilateral 54|678 region	Bilateral large radiopaque mass with surrounding rim of radiolucency in the 54|45 region	Gigantiform cemento
4	F	68	Right mandible	Mixed radiopaque and radiolucent area surrounding the periapical region of 21|123	Periapical cemental dysplasia
5	F	70	Posterior mandible	Radiopacity surrounded by a rim of radiolucency	Cementoblastoma
6	F		All four quadrants of jaw	See case report	No histology done

47 (Fig.1). The radiograph also showed a well-circumscribed radiopaque mass of the maxillary antra. Computed tomography confirmed the presence of these large diffuse sclerotic mandibular masses and revealed involvement of the incisor region (Fig. 2). The bilateral sinus lesions were interpreted as osteomata; however, their appearance and close proximity to the maxillary molar and premolar apices suggest that these lesions were also extrinsic in origin and part of the same cemento-osseous condition (Fig. 3).

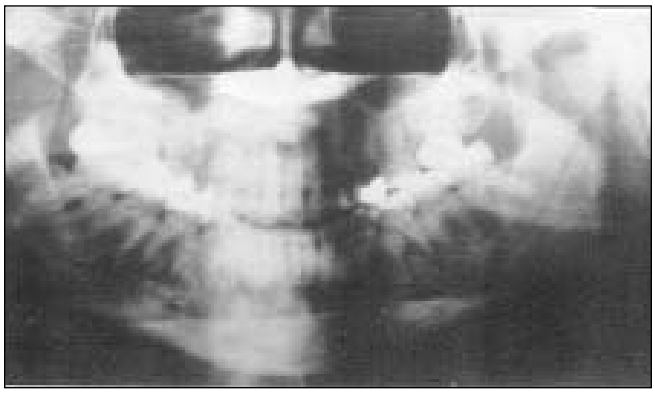

Fig. 1: Dental panoramic tomogram of a patient with FLCOD. Note the bilateral mixed lesion of the mandible and the increased radiopacification of the posterior maxilla

Fig. 2: CT-scan of the mandible confirming the extent of the mixed lesions of the mandible

A diagnosis of FLOD was made based on the above clinical and radiographic findings.

DISCUSSION

The scanty literature on gigantiform cementomas has been reviewed by Punniamoorthy (9) who noted that the origin of the lesion is still a mystery. Kramer (10) and his colleagues

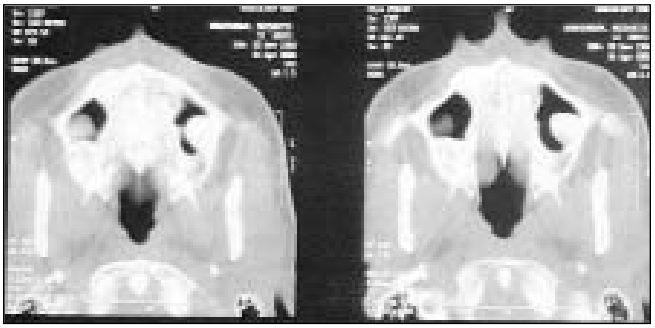

Fig. 3: CT-scan of the maxilla showing the radiopaque mass attached to the walls of the maxillary sinus bilaterally

Fig. 4: Oblique lateral view of the mandible showing a radiopaque mass with a rim of radiolucency around it. The histological diagnosis was cementoblastoma

in the WHO odontogenic group have suggested that gigantiform cementoma is a form of dysplasia or even harmartomatous in nature. Punniamoorthy (9) also pointed out that numerous cases of lesions of the jaws have been reported in the literature which are very similar to gigantiform cememtoma in terms of clinical, radiographic and histologic features but yet have been described under different terms such as chronic sclerosing osteomyelitis, sclerosing/sclerotic cemental mass, chronic productive osteitis, osseous dysplasia and multiple exostosis. Similar masses have also been noted to occur in some cases of osteitis deformans or pagets disease of bone.

It is significant to note the difference in the characteristic radiographic appearance of both the cementoblastoma and the gigantiform cementomas. The cementoblastomas do have a rim of radiolucency around them (Fig. 4). Radiologically, however, the three cases of gigantiform cementoma in the series of jaw bone tumours in Jamaica closely resembles that which is detailed of the cementoblastomas (11, 12) as all three cases do have a radiolucent rim around the periphery of the radiographic mass. As such, it would seem that both cementoblastomas and gigantiform cementomas constitute an important differential diagnosis for each other at radiologic level.

From the only case documented so far in Jamaica of periapical cemental dysplasia, it is very difficult to state conclusively that the clinical and radiological behaviour of this lesion differs from what has been previously documented. It is of interest that only one case of periapical cemental dysplasia was found, despite its prevalence amongst the West Indian population in the United Kingdom. It is very likely that this condition is presently under-reported in Jamaica because it is symptomless and is only a chance finding on routine radiography which is not a common practice in Jamaica. Hence, the real incidence of periapical cemental dysplasia in Jamaica is more than that recorded in this series of COD.

In this review, we report a multi-quadrant fibro-osseous lesion which has been designated gigantiform cementomas or familial multiple cementomas in the first edition of the WHO histological typing of odontogenic tumours, jaw cysts and allied lesion. In retrospect, Case 1 in this study may actually be a case of focal cemento-osseous dysplasia. Summerlin and Tomich (13) pointed out the unique features of this condition that place it in the spectrum of COD. They presented data on 175 examples of what they termed focal cemento-osseous dysplasia (FCOD) for the first time. They also contrasted these cases with 45 cases of cemento-ossifying fibroma, a benign neoplasm. They pointed out that FCOD was probably more common than is appreciated and that it is likely to be misdiagnosed as cemento-ossifying fibroma. Focal cemento-osseous dysplasia lesions are solitary and patients are asymptomatic in most instances; there is no cortical expansion. Almost all cases are discovered on routine radiography. Radiographically, a solitary lesion of FCOD may present as a radiopacity with a narrow rim of decreased radiodensity in the mandible. It is for this reason that we can diagnose case 1 as FCOD retrospectively. Melrose *et al* (14) described a condition that has come to be accepted as the most clinically extensive form of COD, hence the use of the term florid. Prior to the publication of their articles, cases of FLCOD had been published under at least 12 different names, such as gigantiform cementoma, chronic sclerosing osteomyelitis, sclerotic cemental masses and multiple enostosis. This terminologic jungle has fortunately come to an end. FLCOD is more common in middle-aged black women. In their series of 34 patients, Melrose *et al* (14) reported on 33 females and a male. It is now established that the condition occurs in all ethnic groups (14-16).

Clinically FLCOD may present in patients as cortical expansion, particularly of the mandible. The expansion may be pronounced enough to cause the practitioner to suspect a neoplasm of pagets diseases of the bone. Infection may be absent, but dull aching sensation of intermittent nature may be the presenting feature in the mandibular molar region. The teeth are vital and there is no evidence of other pathology that may be responsible for the symptoms and the disease is discovered by examination of routine radiographs.

Florid-cemento-osseous dysplasia was a term proposed in the 2nd edition (10) of the World Health Organization (WHO) "international histological classification of odontogenic tumours" to replace the 1st edition gigantiform cementoma (17). FLCOD lesions are lobulated masses of dense, lightly mineralized almost acellular cemento-osseous tissue typically occurring in several parts of the jaw (10). It is important to note that whilst the 2nd edition WHO classification maintained the definition of FLCOD, it modified the definition of periapical cemental dysplasia (17), another cemento-osseous dysplasia which mostly affected the mandibular incisor region. Unfortunately, this modification confused the boundary between FLCOD and PCD, if they are actually two distinct pathological entity (we have been very careful not to say distinct histopathological entity). The main distinction between FLCOD and PCD is that for PCD each periapical lesion is self-limiting and rarely exceeds 1cm in diameter. The two lesions are similar histologically and also similar histologically to cemento-ossifying fibroma and fibrous dysplasia. Waldron commented that the majority of cases called chronic sclerosing osteomyelitis were actually FLCOD (18).

Radiographically a wide spectrum is seen (16). The reported case presented as a four-quadrant lesion on radiographs. Radiographically FLCOD usually presents as diffuse distribution of lobular irregularly shaped radiopacities throughout the alveolar process. They may also have a ground glass appearance.

These variable features of FLCOD mitigate against the diagnosis of fibrous dysplasia, cemento-ossifying fibroma and to a lesser extent, pagets disease of the bone. Concomitant simple bone cysts are occasional features of

FLCOD. In a patient without simple bone cyst formation, the diagnosis of FLCOD is a clinical or radiographic one. Biopsy is not necessary. A patient must manifest the typical changes in at least two quadrants for a clinical diagnosis of FLCOD to be made. Evaluation of serum alkaline phosphatase level and skeletal survey would suffice to rule out any suspicion of pagets disease of the bone.

FLCOD may have a familial nature, hence familial FLCOD. In 1953, Agazzi and Belloni (1) described an Italian family in which several members manifested four-quadrant disease that had begun at an early age and resulted in facial disfiguration. The management of FLCOD consists of clinical and radiographic observation for the life of the patient as well as excellent periodontal and restorative care to the dentition. This was the management of choice for this reported case.

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Aggressive Infantile (Desmoid-type) Fibromatosis of the Maxilla

A Case Report and New Classification

C Ogunsalu, S Barclay

ABSTRACT

This paper describes the clinical, radiographic and histologic findings of an aggressive infantile (desmoid-type) fibromatosis of the face in a seven-year-old black Jamaican male. This condition is rare in the head and neck region and its occurrence in the maxilla is exceptional. The differential diagnosis, management and long term follow-up of this case are also mentioned. The need for a less aggressive surgical management in this child and long-term follow–up is stressed. Also, its occurrence in someone of African descent has not been reported previously. The absence of recurrence, eight years after surgery is significant. This paper discusses the differential diagnosis and treatment of aggressive infantile fibromatosis and suggests a classification of the condition.

INTRODUCTION

Aggressive fibromatosis is a non-metastasizing tumour-like fibroblastic growth of unknown pathogenesis involving voluntary muscle as well as aponeurotic and facial structures. Histologically, it is indistinguishable from an abdominal fibromatosis. The lesion has a strong tendency for local recurrence and aggressive infiltrating growth. It is most common in the shoulder girdle, the thigh and gluteal region of growing adults (1).

Aggressive fibromatosis of the oral or para-oral structures is a very uncommon finding. Melrose and Abram (2) reported three cases involving the jaws of children. They discussed the protean nature of this lesion. Our case presented as a rapidly enlarging lesion post-trauma, although some cases may be quite slow in growth; pain may or may not be a finding. Most cases of aggressive infantile fibromatosis were clinically misdiagnosed as fibroma, fibrous histocytoma, granuloma, cyst, ameloblastoma, fibrous dysplasia or sarcoma. Sarcoma was the initial diagnosis in this case; however, the histopathological confirmation as aggressive fibromatosis was prompt and management was appropriate.

It is said that some childhood lesions proliferate very rapidly and histologically can be very cellular and active so that a diagnosis of sarcoma is seriously entertained and radical treatment carried out. Occasionally, the histo-morphology may fail to reflect the biological behaviour of the lesions which can occasionally be localized, such as myofibromatosis, and as such be amenable to conservative surgery. On the other hand, some childhood fibrous lesions such as infantile fibromatosis may grow in a persistent and infiltrative manner. These lesions continue to present a difficult diagnostic problem, especially to pathologists (3-5). The two lesions commonly confused with infantile fibromatosis are myofibromatosis and fibrosarcoma. It is very important to distinguish between these conditions as they may display quite different clinical behaviour. The distinction between infantile fibromatosis and fibrosarcoma is a problem for pathologists as well as being of academic interest. Fortunately, the infantile fibrosarcoma may display attenuated behaviour compared to its adult counterpart. They have reduced metastatic potential but may recur locally much like the fibromatosis (5). It is claimed that the treatment for both should be complete excision.

Case Report

A seven-year-old black Jamaican boy presented to us on February 11, 1995, with a painless firm swelling of the left cheek and infra-orbital region. The swelling was not attached to the skin but clinically appeared to be bony hard. It measured about 2 cm in the longest diameter. The mother associated the occurrence of the lesion to a previous trauma to the face following an alleged assault. She claims that the lesion has increased rapidly in size over a short period.

Radiographic Findings

Radiologically, the occipitomental view (standard) showed an extensive radiopaque lesion of the left zygomatic bone, extending up to the region of the zygomatico-frontal suture line (Fig. 1). No bony destruction of the orbital or antral wall was noted. On initial examination, a diagnosis of facial osteoma was made; however, malignant tumours such as osteosarcoma and fibrosarcoma were also considered based on the history of recent onset of swelling and rapid growth thereafter.

Treatment – excisional biopsy

The treatment was that of a total excision of the lesion – with nibbling of bone at the base in all areas. At surgery, the lesion was found to consist of soft (fibrous) tissue essentially

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and not osseous tissue as was suggested by the clinical and radiological examination. All the tissues obtained at surgery were submitted for histopathology.

Sections of tumour, or histology, showed a diffuse growth of mature appearing fibroblasts arranged in distinct bundles and fascicles associated with variable amount of collagen. It appeared that the growth began in relation to fascia or periostium and small foci of ossification were noted at the periphery (Fig. 2 a & b). Also vascular spaces are seen. The overall picture is that of infantile (desmoid-type) fibromatosis.

Fig. 1: Occipitomental radiograph showing radiopaque lesion of the left zygomatic bone (see arrow)

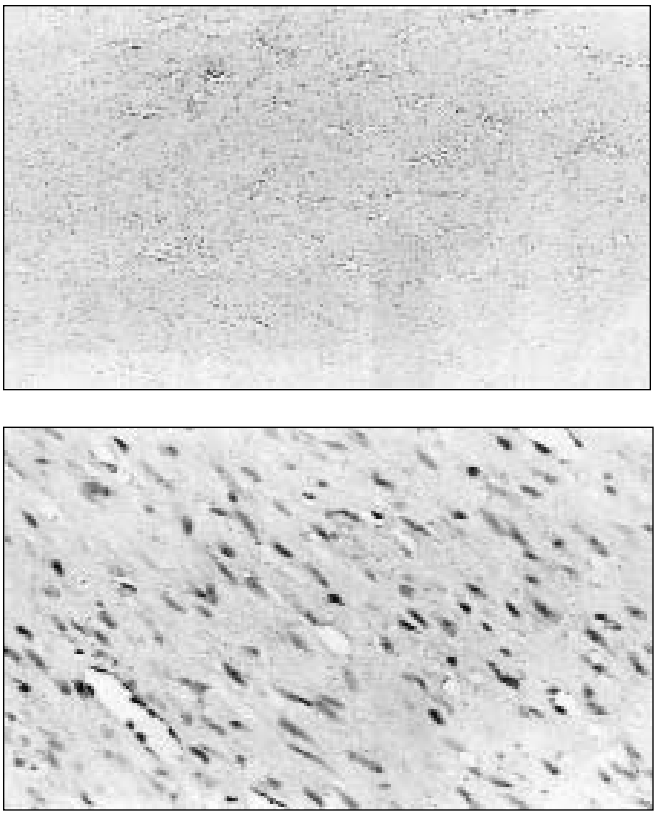

Fig. 2a & b: Low power x 85 and high power x 200, respectively, showing mature fibroblast arranged in distinct bundles and fascicles associated with variable amount of collagen

DISCUSSION

Aggressive fibromatosis belongs to a sizeable group of the so-called "miscellaneous locally aggressive fibrous lesions". They are non-metastasizing and must always be differentiated from fibrosarcoma, particularly the well-differentiated type. In the past, many of these benign but locally aggressive lesions have been confused with sarcoma and it is only in recent years that the pathologists have been able to separate these lesions with any assurance (1).

The group consists chiefly of the following: nodular fasciitis (psuedosarcomatous fibromatosis); aggressive fibromatosis (extra-abdominal desmoid); proliferative myositis; fibrous histocytoma (fibroxanthoma); atypical fibroxanthoma (and malignant variant) and desmoplastic fibroma of the bone.

It is unclear whether or not trauma played a role in the aetiology of this case, or whether it was co-incidental. All these lesions are quite uncommon in the oral cavity. Aggressive infantile fibromatosis may cause destruction of the bone when in apposition with such. Fortunately, this lesion did not destroy the underlying bone.

The microscopic appearance of these lesions is quite uniform, however, consisting of cellular interlacing bundles of elongated fibroblasts showing no pleomorphism, little or no mitotic activity and no giant cells (1). Typically, it shows numerous slit-like vascular spaces not associated with inflammation.

The treatment of this patient was that of complete surgical excision with generous margin, without any residual facial disfiguration even though the diagnosis had not been confirmed at the time of surgery. There has been no evidence of recurrence, after eight years but we recommended long-term follow-up.

Clinically and radiologically, it is almost impossible to make a diagnosis of infantile fibromatosis, a condition which may or may not be aggressive. When aggressive, a diagnosis of malignant neoplasm is usually suggested until the result of histopathology is available. Interesting but quite disturbing is the widely accepted fact that it can be difficult to differentiate it from low-grade fibrosarcoma and as such eventuate in mismanagement of the cases.

Table 1: Summary of literature review for cases of aggressive infantile fibromatosis – (1974 – 2000)

Case No.	Author	Year	Age	Gender	Anatomic area central = c, peripheral = p, no precise detail =?	Preliminary diagnosis	Time of diagnosis	Radiographic findings
1	Pindborg and Hjrting-Hanson	1974	3 years	Male	Left inferior border of the orbit	-	-	Radiolucency
2	Wilkins *et al*	1975	3 years		Anterior palate?	-	-	Radiolucency
3	Melrose and Abram	1980	5 years	Female	Palate, right maxillary ridge (p)	-	1 month	Loss of interdental bone
4	Melrose and Abram	1980	3 years	Female	Mandible and floor of mouth	-	-	-
5	Bertrand *et al*	1981	9 ½ years	Female	Right maxilla (?)	-	6 months	-
6	Goopfert *et al*	1982	2 years and 9 months	Male	Right upper gingival (p)	-	-	-
7	Tagwa *et al*	1989	3 years	Female	Submandibular region	-	-	-
8	Carr *et al*	1992	2 years	Male	Left mandible (c)	-	2 years	Radiolucency
9	Carr *et al*	1992	2 years	Male	Left mandible (c)	-	1 year	Radiolucency
10	Ramanathan and Thomas	1997	7 years	Female	Parotid gland	-	-	-
11	Sato *et al*	2000	3 years	Male	Mandible (c)	Malignancy	-	
12	Donohue *et al*	1990	14 years		Maxilla (left palate) (c)	Fibroma	-	
13	Ogunsalu and Barclay	2003	7 years	Male	Left cheek and infraorbital region	Fibrosarcoma and osteosarcoma	-	Radiopacification

The consideration of the clinical course, radiological finding and histopathology finding can assist in making a definitive diagnosis. Unlike fibrosarcoma, the aggressive infantile fibromatoses never metastasize (3), although they have a potential to produce fatal outcome from extension into vital organs.

In the early 1950s, Stout (4) reported on the state of confusion around the term fibromatosis and noted that there was nothing to gain by retaining the older names such as non-metastasizing fibrosarcoma.

A review of 241 cases of juvenile fibromatosis by Stout (5) distinguished it from fibrosarcoma by identifying features that would be indicative of potentially metastatic behaviour. The description 'aggressive' is based on the invasive characteristic of the lesion and the rate of growth. It is our opinion that, to avoid further confusion, other synonyms such as extra-abdominal desmoid, juvenile fibromatosis, congenital fibrosarcoma should be discontinued and the term aggressive or non-aggressive infantile fibromatosis retained based on the rate of growth and clinical course with or without treatment, as it is documented that this tumour has been known to regress without any form of treatment.

Bridget *et al* (6) observed chromosomal abnormalities in their analysis of 26 cases of desmoid tumour (6). We suggest that trauma, such as birth trauma and childhood trauma, is probably necessary to initiate the condition in those with genetic predisposition. It is for this reason that we suggest that a complete paediatric history be an important aspect in the investigation of these patients. None of the published cases indicated that paediatric history including perinatal and postnatal history was taken. We reviewed 12 published cases of aggressive infantile fibromatosis (7-15) of the jaws as shown in Table 1. The male: female ratio was 1:1, with an average age of 4.94 . The age range was 2 - 9.5 years. The maxilla was more involved (nine cases) than the mandible (three cases). The radiographic finding was that of radiolucencies of the affected jaw mainly. However, the index case herein reported presented with radiopacification of the maxilla, a reason for favouring the diagnosis of osteogenic sarcoma initially.

In their classical paper of 1992, Carr *et al* (12) described the clinicopathological finding of two unusual cases of infantile fibromatosis of the mandible of two-year-old children. These tumours, though highly aggressive initially, underwent spontaneous regression in the absence of definitive treatment. These authors avoided the term aggressive in the title of their classical article. In the light of our current clarification of terms, they should have called these two cases atypical aggressive infantile (desmoid-type) fibromatosis. Further, we suggest that if the term atypical or non-aggressive is not found desirable, then aggressive infantile fibromatosis should be retained and classified as grades A, B, C and D: grade A - clinically aggressive,

histologically confirmed tumour and clinically recurrent after aggressive surgical treatment; grade B - clinically aggressive, histologically confirmed tumour and clinically non-recurrent after aggressive surgical treatment; grade C - clinically aggressive, histologically confirmed tumour and clinically non-recurrent after non-aggressive surgical treatment; grade D - clinically aggressive, histologically confirmed tumour and clinically regressive after no definitive surgical treatment.

This classification is as such retrospective and best done after at least two years post surgical follow-up. Table 2 shows the type of treatment and our new retrospective grading for aggressive infantile fibromatosis. From a review of the English-speaking literature, it is obvious that despite the variability in the clinico-pathologic behaviour and progression of all pathologies ascribed "aggressive infantile fibromatosis", no classification has been developed. It is for this reason that we favour our new classification.

Table 2: Showing type of treatment and new retrospective grading of aggressive infantile fibromatosis

Case	Type of Treatment	Recurrence	Grade
1	Aggressive surgical resection	none	**B**
2	Aggressive surgical resection	yes – after one month	**A**
3	Aggressive surgical resection	no	**B**
4	Not sure	none	**?**
5	Aggressive surgical resection	lost to follow-up	**?**
6	Not sure	none	**?**
7	Resection	none	**B**
8	No definite treatment	regression	**D**
9	No definite treatment	regression	**D**
10	Complete surgical excess of the patoid gland	none	**B**
11	Marginal mandibulectomy +reconstruction with iliac crest bone.	none	**B**
12	Excision of lesion	recurrence	**B**
13	Excision of lesion (conservative but total)	none	**C**

CONCLUSION

Aggressive infantile (desmoid-type) fibromatosis of the face may appear to be malignant in nature based on the clinical presentation and radiographic findings, particularly when it has caused destruction of bone. Pathologists are now able to separate this lesion from sarcomas with much greater certainty and assurance. Local excision is the treatment of choice with much emphasis on long-term follow-up. The clinical features and radiographic findings should at least point to the diagnosis of aggressive fibromatosis or low grade fibrosarcoma. Subsequently, the absence of features that would be indicative of potentially metastatic behaviour should allow a definitive diagnosis of aggressive infantile fibromatosis to be made without the use of the previously utilized multitude of diagnostic terms. Finally, we suggest that the aetiology is likely trauma (perinatal, postnatal, or early childhood trauma) in a rare group of genetically predisposed patients.

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Increased Copper Level in Oral Mucosal Tissue of Submucous Fibrosis Patients Chewing Areca Nut Products

The Editor,

Sir,

Oral submucous fibrosis (OSMF) is a crippling disease that impedes the normal functions of the oral cavity. It is a slowly progressive disease characterized by epithelial atrophy, abnormal accumulation of collagen fibres in the sub-epithelial tissues leading to severe restriction of mouth opening and movement of the tongue. The disease is believed to be a localized collagen disorder.

Chewing areca nut alone, or as a component of betel quid, is widespread in the Indian subcontinent. Areca nut chewing is also causally linked to OSMF (1). Areca nut has a high copper content (302 nmol/g), a substantial amount of which is released into saliva while chewing (2). The role of copper in submucous fibrosis is not clearly understood although it is known that the copper dependent enzyme, lysyl oxidase, secreted by the fibroblasts, facilitates the cross-linking of collagen, thereby inhibiting its degradation (3).

The aim of this study was to determine the copper level in serum and buccal mucosa of OSMF patients who are habitual chewers of areca nut-containing products such as gutka, pan and pan masala. (Gutka is a commercially available preparation containing areca nut, tobacco, small quantities of slaked lime and catechu in a dry form).

This study was carried out on 40 patients with OSMF who attended the Department of Oral Medicine, College of Dental Sciences, Dharwad, India. The mean ages of these patients ranged from 17 to 44 years (23.40 ± 6.25 years). A detailed case history, with specific reference to their chewing habits (type, brand, duration, frequency) was recorded. Seven patients were cigarette smokers, eight consumed alcohol occasionally and twenty-two consumed excessive quantities of chilies. All patients complained of burning sensation in the mouth, especially in the cheeks, tongue and floor of the mouth. None of the patients had received any kind of treatment for OSMF and none was suffering from any systemic diseases. The selection of these patients was based on the following clinical criteria: positive history of areca nut chewing, burning sensation in the mouth on eating normal spicy food, history of gradual restricted mouth opening, blanched, mottled and pearly appearance of buccal mucosa with presence of fibrous bands, difficulty in protruding the tongue, involvement of uvula, soft palate, lips, faucial pillars, clinically palpable fibrous bands on the buccal mucosa and other areas of the oral cavity.

Normal healthy controls (n = 31) were selected in the age group of 17 to 44 years (23.09 ± 5.96 years). The control group did not chew areca nut nor consume tobacco in any form. They had normal healthy looking mucosa and did not have any systemic disease.

Copper levels in the serum and buccal mucosa were estimated by atomic absorption spectrophotometry. Tissue specimen from the buccal mucosa was taken by incisional biopsy from the area that showed maximum involvement.

The serum level of copper in the OSMF patients and healthy control subjects was 75.6 ± 10.6 micrograms/100 ml and 80.5 ± 11.9 micrograms/100 ml, respectively. Copper level in the oral mucosal tissue in the OSMF patients and healthy control subjects was 1.71 ± 0.49 micrograms/100 mg (n = 40) and 0.69 ± 0.22 micrograms/100 mg (n = 31), respectively. No significant difference in serum copper level was observed between the OSMF patients and control subjects ($p > 0.05$), whereas the difference in copper level in the tissue was significant ($p < 0.01$), the level being 2.47-fold higher in the patients. There was no correlation between the copper level in serum and tissue of the two groups and the extent of mouth opening ($r = 0.3103$ and $r = 0.0961$, respectively).

The only report of tissue copper level in healthy and OSMF patients, determined by quantitative X-ray microanalysis, was that of Trivendy *et al* (4) who reported a mean copper level of 6.5 μg/g in OSMF cases (n = 7) and 2 μg/g in the non-areca nut-chewing controls (n = 2). The high amount of copper in areca nut along with the high exposure to the oral tissues during chewing could have increased the local absorption and accumulation.

It may be hypothesized that the extent of absorption of copper into the systemic circulation is reduced due to the fibrosis and reduced vascular supply. It is also possible that the denatured proteins like amyloid and β-proteins, which have a low turnover rate, may bind bivalent metal ions such as copper and could cause a net accumulation. The increased copper level in the tissue, which is already damaged by the chronic irration, could predispose, initiate or perpetuate the disease or the accumulation may be the after effect of OSMF following alterations of tissue morphology. Other controls such as areca nut users without OSMF may be used to further study the relationship between copper and OSMF. A mean increase of 247.8% copper level in the oral mucosal tissue of OSMF patients in the present study is significant and warrants further research.

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Permanent teeth

upper right								upper left							
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
lower right								lower left							

Deciduous teeth

upper right						upper left				
55	54	53	52	51	61	62	63	64	65	
85	84	83	82	81	71	72	73	74	75	
lower right						lower left				

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